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TABLE OF CONTENTS.

LEADING ARTICLES: Page.

A Large Stone-Crushing Plant at Gary, Ill. (Illustrated)..... 367
The Influence of the Saline Constituents of Sea Water on the Decomposition of Sewage; J. E. Purvis and C. J. Coleman..... 367
Statistics of Railways in the United States..... 369
Continuous Beams or Shafts Having Three Supports (illustrated); E. Wagner 370
A Steel Viaduct with Concrete Casing and Floor (illustrated)..... 371
The Transporter Bridge at Newport, England (illustrated)..... 372
New Shops of the Cincinnati, Hamilton & Dayton Ry., at Ivorydale, Ohio.... 372
Results Obtained with the Kjellin Electric Steel Furnace; E. C. Ibbotson..... 373
Grouting a Leaky Tunnel on the Paris, Lyons & Mediterranean Ry. (illustrated) 374
The Cost of Deep-Water Dredging with a Clamshell Dredge for the Stony Point Extension of the Buffalo, N. Y., Breakwater; Emile Low, M. Am. Soc. C. E. 375
A New Conduit for the Water Supply of Vienna, Austria (illustrated)..... 376
Ordinances Relating to the Installation and Inspection of Elevators and the Use of Asbestos Theater Curtains in Philadelphia..... 376
A European Brake Adjuster and Indicator (illustrated)..... 377
The Decomposition of Cements in Sea Water; H. Le Chatelier..... 377
An Interesting Water Power Decision: Union Water Power Co. vs. City of Lewiston, Me..... 377
Additional Information on the Durability of Wooden Stave Pipe (illustrated); Arthur L. Adams..... 378
The Petroleums of North America; Clifford Richardson..... 378
The Production of Coal in the United States in 1904 and 1905..... 379
Uniform Symbols for Wiring Plans..... 379

Page.

The Towing Resistance of a Floating Dock (illustrated); Henry Aylwin Bevan Cole, M. Inst. C. E..... 380
Concerning a Method of Automatic Lubrication for Small High-Speed Engines. 380
The Second Annual Excursion of the Canadian Society of Civil Engineers.—Montreal to Victoria and Return (illustrated)..... 384
The Failure of a Reinforced Concrete Chimney at Peoria, Ill. (illustrated).... 387
Electric Pump Equipment for a Deep Mine Shaft (illustrated)..... 387
A New Design of Steel Sheet-Piling (illustrated)..... 388
Single-Phase Equipment for the Washington, Baltimore & Annapolis Ry.... 388
EDITORIAL..... 381
English Railroad Accidents—The "Aerial Ferry" Type Bridge—The Durability of Wood-Stave Conduits—The Utilization of the Heat of Refuse Destruction for Power Purposes—The Pacific Coast Excursion of the Canadian Society of Civil Engineers.
Why not Ship Cement in Bulk?..... 382
LETTERS TO THE EDITOR..... 383
The Amount of Water Used in Fighting Fires in New York City; Ira W. Sylvester—More Information Needed on the Cost of Maintenance of Timber Trestles; Daniel Bontecou—On the Margin of Safety in Bridges and Other Steel Structures; Edwin Duryea, Jr.—Notes and Queries.
ENGINEERING NEWS OF THE WEEK..... 388
PERSONALS..... 390
ENGINEERING SOCIETIES..... 390

A LARGE STONE CRUSHING PLANT AT GARY, ILL.

A large stone crushing plant has recently been put in operation at Gary, Ill., by the Dolese & Shepard Co., of Chicago, and is the largest of the five plants operated by that company. The plant is not only of large capacity, but has an interesting machinery equipment for the crushing and handling of the stone. The small town of Gary is occupied mainly by the company's employees, and is situated near the Chicago Drainage Canal, on the line of the Atchison, Topeka & Santa Fe Ry. The company, however, has built a railway of its own into Chicago (15 miles), the road being incorporated as the Chicago & Illinois Western Ry. and connecting with the principal trunk lines near Western Ave. At Gary, the company owns about 280 acres of land, which has a very thin covering of soil over a deep bed of limestone, so that very little stripping is required.

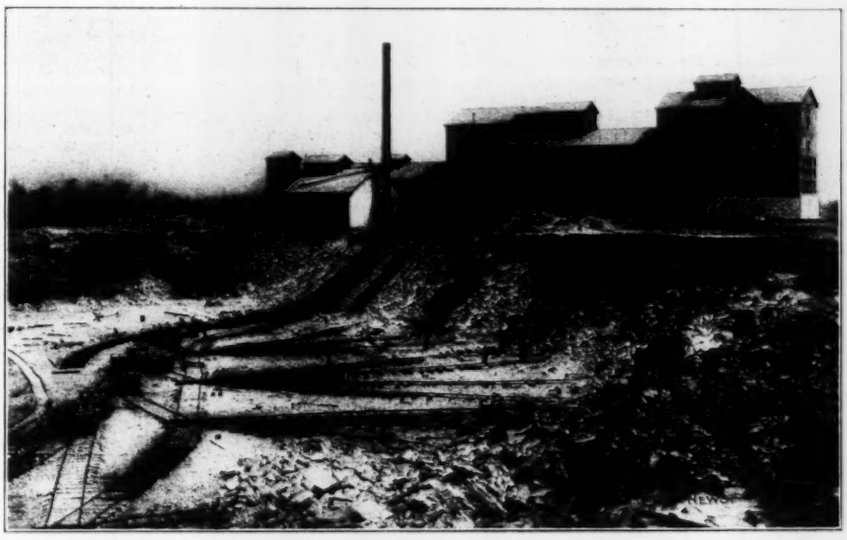

FIG. 1. VIEW OF QUARRY AND STONE CRUSHING PLANT AT GARY, ILL.; DOLESE & SHEPARD CO., CHICAGO.

The main building, shown in Fig. 1, is near the south side of the quarry, and connected with it by a cable incline described below. It is a frame structure, 40 × 317 ft. in plan, with massive concrete foundations for the machinery, and has on each side a loading track for railway cars. At one end of this building is the engine room, the principal equipment of which consists of a 600-HP. Allis cross-compound Corliss engine, and an Ingersoll-Sergeant air compressor with a capacity of 2,200 cu. ft. of free air per minute. The air is compressed at a pressure of 100 lbs. in a large tank, from which pipes are led to the quarry. The engine flywheel is belted to a countershaft carrying a belt wheel for driving the large crusher, and two grooved pulleys for Dodge rope drive systems; one of these is for the screens and elevators, and the other is for the smaller crushers. This arrangement is shown in Fig. 2. The crushers are all Gates machines, and the largest (No. 9) has a capacity of 300 tons per hour; there are two smaller machines (No. 6) recrushing to the smaller sizes, while space is provided for three more of these smaller machines. The boiler house is a separate building, of brick construction, and contains four Kewanee boilers of 150 HP. each. A tunnel carries the exhaust and drip pipes from the main building, while the steam pipes are carried overhead.

The quarry is now about 40 ft. deep, with an area of some 35 acres. Compressed air mains are laid around it, with connections for the pipes to the rock drills, of which about 12 are in use; these include 5-in., 2-in. and "Jap" drills. A system of belt tracks of standard gage is laid around the floor of the quarry; the outer track is for empty cars and in this are turntables, from each of which radiate four or five tracks to the working face, while another track connects with the inner belt line for loaded cars. The rock is loaded into rectangular steel cars of four tons capacity, which are started by hand and drop by gravity on a grade of 1.5% to the foot of the incline leading into the crusher house. This incline has a grade of 40%, and has two sets of tracks so that two loaded cars can be handled and delivered to the crusher simultaneously. The tracks are of 4.7-ft. gage, spaced 10.125 ft. c. to c., with all turnout curves of 50-ft. radius. The switches are three-throw stub switches, with a throw of 0.417 ft., and all the guard rails are 4 ft. long. The rails are of the Am. Soc. C. E. 60-lb. section. Each set of tracks will be served by a double-cylinder double-drum Ottumwa hoisting engine, hauling the cars at a speed of 500 ft. per minute. There will be five tracks eventually, two for the ascending loaded cars and three for the descending empty cars, as shown by the plan, Fig. 3. At present, however, only one hoist is in use, with three tracks; the middle track is for the ascending cars and the two side tracks for the descending cars. The hoisting engines are controlled and the switches operated from levers in a cabin projecting beyond the face of the main building, where the operator has a full view of the cars and switches. At the head of the incline (inside the building) is a dumping arrangement by which the cars are automatically dumped (from the side) onto a floor surrounding the head of the large crusher. The quarry tracks and incline are clearly shown in Fig. 1.

The product from the large crusher is about 4 ins. in size, and is delivered by gravity to a pair of 4-ft. revolving screens, 18 ft. long, the stone from which is raised to a storage bin of 300 tons capacity by two inclined elevating conveyors 80 ft. long; these have sheet steel buckets attached to endless chains. These conveyors are shown in Fig. 4. From this bin the stone can be delivered by chutes into cars on either side of the building, or dropped upon a 36-in. belt conveyor 88 ft. long, which again delivers it to inclined elevating conveyors serving the smaller crushers. The output from these is again raised to a set of two 40-in. revolving screens 24 ft. long, located in the top of the building; these separate it into five sizes. These screens are double or jacketed at the upper end so as to give a double screening for the smaller sizes. From the bins under these screens the stone can be delivered by chutes to cars on the loading tracks outside the building.

The 4-in. stone from the large crusher is used as flux for blast furnaces, and a train load of this is shipped daily to the South Chicago works of the Illinois Steel Co. The smaller sizes are used for railway ballast, street macadam and concrete work. The fine dust or screenings is largely used as a substitute for sand in certain kinds of concrete work, and especially for concrete sidewalks in Chicago.

THE INFLUENCE OF THE SALINE CONSTITUENTS OF SEA WATER ON THE DECOMPOSITION OF SEWAGE.*

By J. E. Purvis† and C. J. Coleman.‡

In considering the action of sea water on the decomposition of sewage, it may be of some importance to ascertain the influence of the principal saline constituents, and how far this influence is exerted, not only by the separate salts, but also by the sea water when it is sterilized and when it is unsterilized. The aim of the following experiments is to show how far the salts dissolved in sea water affect the decomposition into simpler forms of the highly complex constituents of sewage, and particularly with regard to the production of nitrates

*From the "Journal of the Royal Sanitary Institute" (Parkes Museum, Margaret St., W., London, England) for September, 1906.

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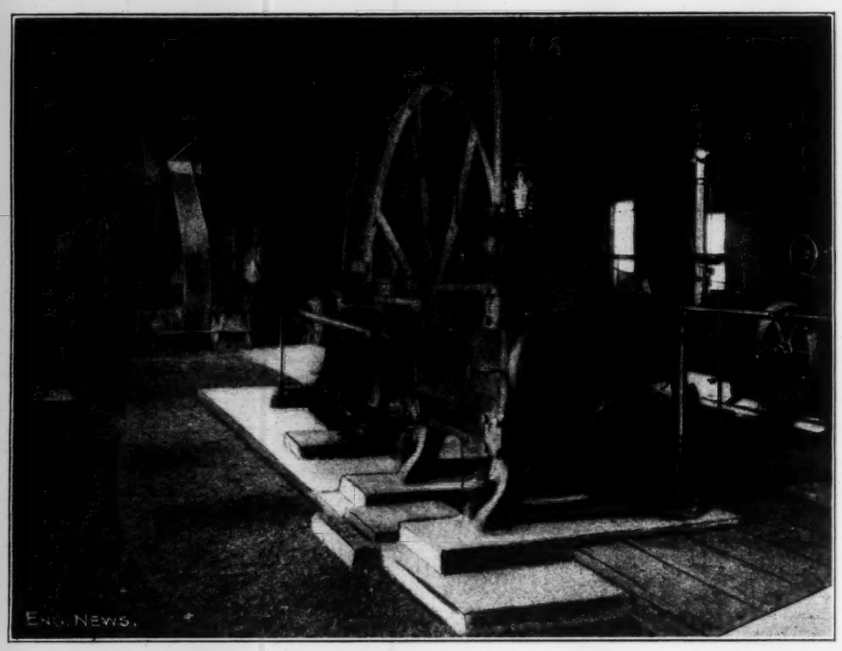


FIG. 2. MAIN ENGINE WITH BELT AND ROPE DRIVE FOR STONE CRUSHING PLANT.

as a final product. The aim of any efficient system of sewage disposal is to break down as rapidly as possible the various complex compounds, so as to produce finally an innocuous non-smelling effluent whose possibilities of future nuisance are reduced to a minimum. The decrease in the amount of the free and albuminoid ammonias, and the increase in the amount of nitrogen as nitrates, are usually considered to be measures of the purification; and the following experiments describe the results obtained in these three directions when sewage is incubated with several of the principal saline constituents of sea water, and with sea water itself both sterilized and unsterilized.

Dr. Adeney's and Dr. Letts' investigations on sea water and sewage, as reported in the evidence of the Royal Commission on Sewage Disposal, Vol. 2, did not attack the problem in the manner to be described, and we point out later several ways in which our methods differed from theirs.

As is well known, the chloride of sodium greatly preponderates over all other salts present in sea water; and it is estimated to be present in the proportion of 28 parts per 1,000 in a sample of water taken from the British Channel. The chloride and the sulphate of magnesium also occur in considerable quantities, being estimated at 3.6 and 2.3 parts per 1,000, respectively. Among other salts present in smaller proportion the chloride of potassium and the sulphate and carbonate of calcium may be mentioned, and this research will be extended to them at a later date.

For the purpose of this investigation the experiments were confined to the action of solutions of NaCl, $MgSO_4$, and $MgCl_2$.

An analysis of sea water from the British Channel is given below. There are variations between such a sample and one taken from the Irish Sea or the North Sea; but as some standard is necessary for making the laboratory solutions, this analysis was adopted from which to make up the solutions of the three salts.

Sea Water of British Channel: Parts per 1,000.

NaCl	28.00	$CaCO_3$	.03
$MgSO_4$	2.30	KCl	.74
$MgCl_2$	3.60	Water	964
$MgBr_2$	.03	Iodides	Traces.
$CaSO_4$	1.30		

It is of some importance to notice that in the Irish Sea the amount of $Mg(NO_3)_2$ is given by Thorp and Morton ("Jahresb. für Chimie," 1870, p. 1380) as .002 parts 1,000. If the N is calculated from this, it will be seen how excessively small it is, being less than 0.04 parts per 100,000. It is difficult to conceive that this represents the final product of the nitrification of the nitrogenous compounds which must have been poured into the sea, in addition to the decomposition products of dead organisms. It seems to show that the ultimate nitrification to nitrates is seriously hindered, and the following experiments prove that such hindrance takes place when the various saline constituents of sea water are incubated with sewage.

METHOD OF EXPERIMENT.

In the course of the following experiments, laboratory solutions of the NaCl, $MgSO_4$, and $MgCl_2$, respectively, were made up with distilled water of such strengths as to be equivalent to that of the corresponding salts found in the above sea water.

A sewage was analyzed for the amounts of the free and albuminoid ammonias, and nitrates and nitrites already present, and it was then treated with the individual solutions of the salts so that each solution contained 1% of the sewage. One liter of this 1% solution of sewage in each saline solution was placed in a Winchester quart bottle. It was well shaken to insure thorough aeration of the contents. During the incubation of the 1% sewage the Winchester quart bottles were kept at a uniform temperature of 16° C. The neck of each bottle was loosely closed by a plug of cotton wool, and the bottle and its contents were shaken from time to time.

As regards the amount of oxygen absorbed from a known strength of a solution of potassium permanganate, it was attempted at first to use Tidy's process, but there appeared to be some doubt as to how far this method could be relied upon in these experiments. The potassium permanganate might act not only on the organic matter, but also upon the chlorides dissolved in the water; and if there is any action, which has not been disproved, the figure obtained would not indicate the oxidation of the organic matter only, but also a proportion of the dissolved chlorides. Therefore it was decided to neglect Tidy's method, and to rely on the figures obtained from the free and albuminoid ammonias and of the nitrites and nitrates as representative of the changes occurring in the sewage.

The two ammonias were estimated by Wanklyn's method, and nitrites by the meta-phenylene-diamine method.

With regard to nitrates, three several methods were tried in order to see which gave the most satisfactory results. It is obviously of great importance to apply the most exact method in determining small quantities of nitrates. [The three methods tried were the zinc-copper couple, the phenol sulphuric acid, and the indigo method. The remarks on the latter, only, are reprinted. —Ed.] Finally the indigo method was investigated, and its limitations with weak solutions. We found we could detect nitrogen as nitrates added to sea water in strengths not less than .005 parts per 100,000; so that in our experiments the value of the nitrates was estimated within these limits; that is to say, if there was nitrogen as nitrates present in the incubated sea water, they must have been in less quantity than .005 parts per 100,000. We found that we could easily estimate nitrogen as nitrates when in solution in sea water in the proportion of .005 parts per 100,000, but the results were unsatisfactory with any proportion below this. This method was chosen, as it seemed to give more satisfactory results in determining small quantities of nitrates. As is well known its principle is based upon the direct oxidation of the indigo by such oxidizing agents as nitrates.

The sewage samples were collected at the sewage farm at Cambridge from the settling tank near the outfall sewer, and nearly always about 3 p. m. As the Cambridge sewage is a domestic one, and trade effluents do not enter into its composition, it is a remarkable fact that all the collected samples showed very high free and albuminoid ammonias, and almost an absence of nitrates.

Before proceeding to describe the experiments, it may be advisable to indicate the points in which the methods of these investigations differ from those of Dr. Letts, as reported in the Royal Commission on Sewage Disposal. The samples of sewage used by Dr. Letts in his experiments were weak as regards the ammonia figures, and in addition to this they were filtered before they were incubated in the 1% solutions. The sewage in these experiments was far stronger in free and albuminoid ammonias, and, though well mixed, it was not filtered, as it was desired to imitate as far as possible the natural course of events when sewage is turned into the sea or a tidal estuary.

As regards the important question of the ultimate nitrification, it is concluded in Dr. Letts' paper that the nitrifying organisms can exist and carry on their work in sea water; but that it is remarkable that such a large proportion of free ammonia remained unnitrified after eleven months. In the later experiments it is admitted that the nitrates present at the commencement of an incubation of 1% sewage with sea water, after a lapse of 21 months have entirely disappeared, or as it is stated in the evidence, "complete denitrification had occurred" p. 481). On the other hand, if any nitrate was produced, may it not have been used up in oxidizing the organic matter in solution? It will be shown in these experiments that the salts in solution in sea water apparently affect the nitrifying organisms, for neither nitrates nor nitrites are produced at any stage of the incubations.

EXPERIMENTS.

In the first series (I. to VI.) solutions of the three salts before mentioned were respectively incubated with 1% of Cambridge sewage. The two ammonias, nitrates and nitrites, were estimated at the end of 24 hours, 48 hours and 17 days, respectively; and the results of the analyses showed (1) that in each salt solution the total amount of the two ammonias was more than trebled in 48 hours, and afterwards there was a very slow production, even after 14 days' incubation; (2) that the NaCl solution appeared to assist in the production of a larger proportionate rise in the albuminoid than in the free ammonia; (3) the largest total effect appeared to be produced by the $MgCl_2$ solution, but the differences were not sufficiently marked to draw definite inferences; (4) the stronger NaCl solution appeared to have the same influence as the weaker $MgSO_4$ solution; (5) the formation

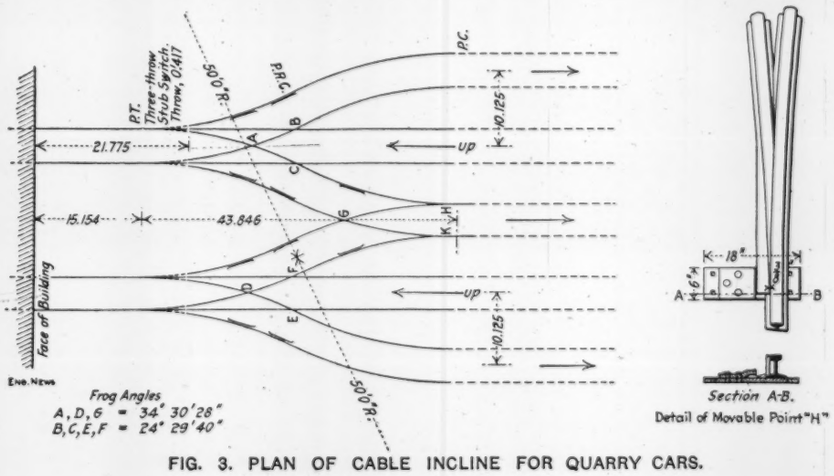


FIG. 3. PLAN OF CABLE INCLINE FOR QUARRY CARS.

of nitrates and nitrites appeared to be entirely checked; and that there was an actual disappearance of small traces of these two bodies in one or two sewage samples. The following table gives the results of Experiment V. as representative of the others. The results are in parts per 100,000; 48 hours' incubation.

Solutions.	Free NH_3.	Albuminoid NH_3.	Total NH_3.	Nitrates and Nitrites.
Original sewage.....	0.31	0.136	0.446	Trace
NaCl solution	0.76	0.660	1.520	Absent
$MgSO_4$ "	0.90	0.500	1.400	"
$MgCl_2$ "	1.14	0.460	1.600	"

And in the following table are the results of the incubation of the NaCl solution (Experiment III.), in parts per 100,000, and extending over 15 days.

Time.	Free NH_3.	Albuminoid NH_3.	Total NH_3.	Nitrates.	Nitrites.
Commencement..	0.36	0.09	0.45	Trace	Absent
2 days.....	1.30	0.58	1.88	Faint trace	"
10 "	1.00	0.28	1.28	Absent	"
15 "	0.90	0.30	1.20	"	"

In another series of experiments (Experiments VII. and VIII.) a 1% solution of sewage was incubated with a mixture of three salts; and analyses made after 1 day, 2 days, 3 days, 5 days and 8 weeks. The results showed (1) that the total ammonia continued to rise until the third day, when it was four times greater than at the beginning, and after that, there was a gradual fall, and (2) that there was no appearance of nitrates or nitrites.

In another series of experiments (IX., X. and XI.), a 1% sewage was incubated with samples of sea water obtained from Lowestoft and also from Stalham off the Norfolk coast, and analyses were made after 1 day, 2 days, 3 days, 6 weeks and 8 weeks. The results were (1) there was only a small rise in the total ammonias by the end of the third day, and then a gradual fall to the original figure by the end of the eighth week, and (2) there were neither nitrates nor nitrites produced at any period.

In another series of experiments (XII., XIII. and XIV.), before incubation the sea water was sterilized in an autoclave for 2 hrs. at 20 lbs. pressure and 126° C. It was then incubated with 1% sewage at 16°C., and analyses made after 2 days, 3 days, 5 days and 8 weeks. The results showed (1) the increase in the total ammonia figure after 3 days was nearly three times the original amount in the Lowestoft water, and more than twice the original amount in the Stalham water, and that afterwards there was a very slow decrease, and (2) there was no production of either nitrates or nitrites.

It appeared that after sterilization the sea water influenced the decomposition of the sewage not unlike that of the artificial laboratory solutions, the sharp rise in the figures for the total ammonia of the sterilized sea water and 1% sewage being much greater than the small corresponding rise in 1% solution of sewage and natural unsterilized sea water. And although the figure for the total ammonias was not so high as in the case of the laboratory solutions when it was three and four times the original quantity, nevertheless the striking inference could be drawn that after sterilizing the sea water, the effect of the salts in solution was very similar to that of the laboratory solutions. It appeared as though by sterilizing the sea water we had removed the chief cause of the difference in behavior between the laboratory solutions incubated with 1% of sewage and sea water similarly treated. Whether this was partly due to the removal of living organisms and partly to a breakdown in the complex compounds in solution brought about by the increased temperature and pressure, is a subject for future work.

GENERAL RESULTS.

So far as they go, the experiments gave the following general results:

(1) A solution of sodium chloride seemed at first to favor the production of free and albuminoid ammonia from sewage up to a certain point only, but the process went no further, and neither nitrates nor nitrites appeared.

(2) The relatively much smaller percentages of $MgSO_4$ and $MgCl_2$ present in sea water did not appear to influence the breakdown of the sewage differently from the high percentage of NaCl, either in the production of the two ammonias or the non-production of nitrates or nitrites.

(3) A mixture of the above salts in solution in their respective relative percentages seemed to influence a greater production of free and albuminoid ammonia from sewage than any single salt in solution. The effect, however, was not an additive one. And again, there was no production of nitrates or nitrites.

(4) The effect of sterilized sea water upon the appearance of the two ammonias from sewage closely resembled the laboratory solutions of the three salts. It is suggested that the salts in solution may act as disintegrating forces upon the organic matter in sewage only up to a certain point. There was no production of nitrates and nitrites.

(5) Sea water in its natural unsterilized condition did not act on sewage in the development of the two ammonias in the same way as the sterilized sea water or the artificial laboratory solutions of three chief saline constituents. The total amount of the free and albuminoid ammonias produced in unsterilized sea water was very small compared with that produced by solutions of the salts contained in sea water, or by the sterilized sea water. They agree in the fact that there was no production of nitrates and nitrites.

(6) One of the most striking effects of (a) the salts in solution, both singly and when mixed in the proportions in which they occur in sea water, and also of (b) the natural sea water, both sterilized and unsterilized, was in the interference in the production of nitrates and nitrites.

These experiments seem to show that, as we have before stated, within the limits of the experimental method employed there was no production of nitrates. In most systems of sewage disposal, the production of nitrates and the disappearance of the two ammonias are considered to be measures of their efficiency; and it is never difficult to estimate the nitrates in such processes. Now, these experiments showed that at no stage of the incubation of 1% solutions of unfiltered sewage with sea water, extending over a period of eight weeks, was there any production of nitrates within the limits of the experimental method before described. It seemed that the decomposition of the sewage did not extend to a complete breakdown into the simple forms of carbon dioxide, water

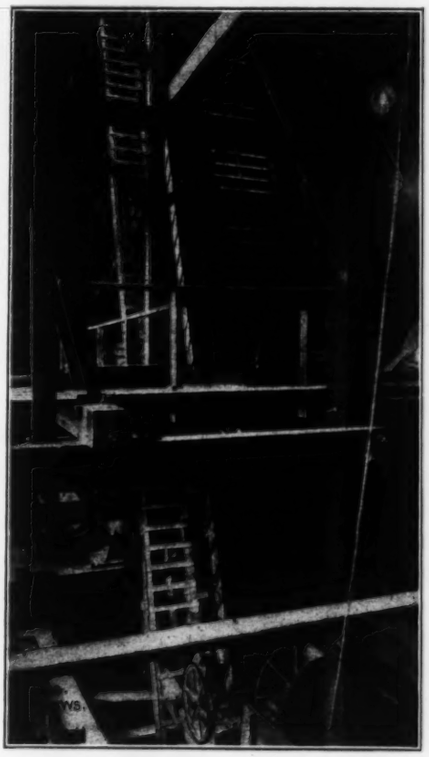


Fig. 4. First Set of Screens and Elevating Conveyors at Stone Crushing Plant.

and nitrates, but that highly complex nitrogenous compounds were still held in solution, which might or might not undergo further decomposition or absorption by the flora and fauna of the sea. We have earlier pointed out the important fact of the small quantity of nitrogen as nitrate found by Thorp and Morton in an analysis of the Irish Sea, and our experiments explain this non-appearance of nitrates.

(7) Finally, we consider that the experiments suggest a practical bearing on the disposal of sewage. They seem to prove that to pour sewage directly into the sea or an estuary is essentially unsound. The intolerable smell produced appears to be due to an incomplete and slow oxidation of the various organic compounds in the sewage. The dissolved salts may interfere with the growth of the useful nitrifying organisms, which would normally and rapidly convert the material into non-odorous and neutral substances such as nitrates. The result is that the substances only slowly decompose, and the various compounds produced cause at times an intolerable nuisance. We think, therefore, that the experiments indicate that if sewage is to be poured into the sea or an estuary near any town or city, it should first be treated by some filtration or bacterial or other process, so that the compounds which cause poisonous and evil smells may be rapidly and efficiently destroyed.

The investigation will be continued, and particularly as to the fate of the nitrifying organisms.

STATISTICS OF RAILWAYS IN THE UNITED STATES.*

The statistics of railways in the United States for the year ending June 30, 1905, show that the total mileage was 218,101.04, or 4,196.70 miles more than at the end of the previous year. The aggregate length of railway tracks, including sidings and second, third and fourth tracks, was 306,796.74 miles, which is an increase of 9,723.40 miles. Of this, 3,449.21 miles, or 35.48%, represented the extension of yard track and sidings.

EQUIPMENT.—On June 30, 1905, there were 48,357 locomotives, an increase of 1,614. These were assigned to different classes of service as follows: 11,618 passenger, 27,869 freight, and 7,923 switching. The total number of cars of all classes was 1,842,871, or 44,310 more than for the year 1904. These were divided as follows: Passenger, 40,713 cars; freight, 1,731,409 cars; company's service, 70,749 cars. The average number of locomotives per 1,000 miles of line was 223, and the average number of cars per 1,000 miles of line was 8,494. Of the 1,891,228 locomotives and cars, 1,641,395 were fitted with train brakes. Only 1.63% of the passenger cars were without automatic couplers. Substantially all the freight locomotives had train brakes and automatic couplers.

EMPLOYEES.—The number of employees on the railways in the United States on June 30, 1905, was 1,382,196, which is equivalent to an average of 637 employees per 100 miles of line. This is an increase over 1904 of 86,075 employees, or 26 per 100 miles of line. Of the employees, 54,817 were enginemen, 57,892 firemen, 41,061 conductors, and 111,405 were other trainmen.

PUBLIC SERVICE.—The passengers carried during the year numbered 738,834,667, this being 23,414,985 more than for the year ending June 30, 1904. The number of tons of freight transported was 1,427,731,905, which exceeds the tonnage of the year 1904 by 117,832,740 tons. The average revenue per passenger per mile was 1.962 cents; for the preceding year it was 2.006 cents. The average revenue per ton per mile was 0.766 cent; for the preceding year it was 0.780 cent. The figures show a slight increase in the average cost of running a train one mile. The ratio of operating expenses to earnings for the year 1905 was 66.78%. For 1904 this ratio was 67.79%.

EARNINGS AND EXPENSES.—The gross earnings of the railways in the United States from the operation of 216,973.61 miles of line were, for the year ending June 30, 1905, $2,082,482,406, being $107,308,315 greater than for the year 1904. The operating expenses were: For maintenance of way and structures, $275,046,036; maintenance of equipment, $288,441,273; conducting transportation, $771,228,666; general expenses, $55,319,805; undistributed, $566,372. Operating expenses averaged $6,400 per mile of line, this average showing an increase of $101 per mile in comparison with the year 1904.

RAILROAD ACCIDENTS.—The total number of casualties to persons on the railways for the year ending June 30, 1905, was 95,711, of which 9,703 represented the number of persons killed and 86,008 the number injured. Casualties occurred among three general classes of railway employees, as follows: Trainmen, 1,990 killed and 29,853 injured; switch tenders, crossing tenders, and watchmen, 136 killed, 883 injured; other employees, 1,235 killed, 36,097 injured. The casualties to employees coupling and uncoupling cars were: Employees killed, 230; injured, 3,543. The casualties connected with coupling and uncoupling cars are assigned as follows: Trainmen killed, 217; injured, 3,316; switch tenders, crossing tenders and watchmen killed, 6; injured, 128; other employees killed, 7; injured, 99. The casualties due to falling from trains, locomotives, or cars in motion were: Trainmen killed, 407; injured, 4,645; switch tenders, crossing tenders and watchmen killed, 12; injured, 126; other employees killed, 60; injured, 559. The casualties due to jumping on or off trains, locomotives, or cars in motion were: Trainmen killed, 119: in-

*Abstract of Statistical Report of the Interstate Commerce Commision.

jured, 3,798; switch tenders, crossing tenders and watchmen killed, 4; injured, 111; other employees killed, 49; injured, 628. The casualties to the same three classes of employees in consequence of collisions and derailments were: Trainmen killed, 579; injured, 4,736, switch tenders, crossing tenders and watchmen killed, 8; injured, 37; other employees killed, 85; injured, 750.

The number of passengers killed in the course of the year 1905, was 537 and the number injured 10,457. In the previous year 441 passengers were killed and 9,111 injured. There were 341 passengers killed and 6,053 injured because of collisions and derailments. The total number of persons other than employees and passengers killed was 5,805; injured, 8,718. These figures include the casualties to persons trespassing, of whom 4,865 were killed and 5,251 were injured. The total number of casualties to persons other than employees from being struck by trains, locomotives or cars was 4,569 killed and 4,163 injured. In 1905, 1 passenger was killed for every 1,375,856 carried, and 1 injured for every 70,655 carried. For 1904 the figures show that 1,622,267 passengers were carried for 1 killed, and 78,523 passengers were carried for 1 injured.

CONTINUOUS BEAMS OR SHAFTS HAVING THREE SUPPORTS.

By E. Wagner.*

The extended use of shafts having three or more supports, as in marine use, gas engines, ice machines, etc., makes it necessary to simplify the old and tedious method of figuring the dimensions of such a shaft. This method is so wearisome that usually we have to be satisfied with an approximate calculation, in which the influence of continuity across the middle bearing is neglected, that is, the shaft is divided into two parts and considered as two separate beams. In some cases we rely upon practical rules-of-thumb, as for instance in marine engineering. In doing this we cannot see the magnitude of the error committed (except when the shaft happens to break) and the calculation remains more or less a blind guess.

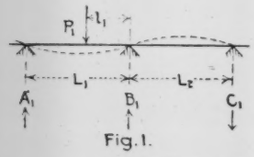


Fig. 1.

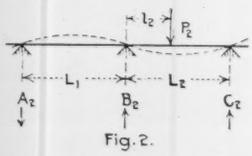


Fig. 2.

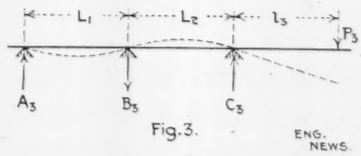


Fig. 3.

The purpose of the writer is to give a handy table for use in determining the dimensions of a shaft having three supports, and to give formulas by means of which exact values may be found for conditions not specified in the table. The derivation of these formulas is not given here, but any one familiar with the theory of beams should be able to derive them provided he employs the same assumptions as here used.

The assumptions made in deriving the formulas and tables are:

1. The neutral axis of the unstrained beam is a straight line.

2. The moment of inertia is the same for all cross-sections of the beam.

3. The modulus of elasticity is constant, i. e., the beam consists all the way through of the same material.

4. The temperature of the beam is constant throughout a given cross-section.

5. The deflection of the beam at the supports is zero, i. e., the bearings are in line.

A theory of this subject is established even for cases in which the restricting conditions above specified do not apply, but as the aim of this article is to make computation less wearisome, it was thought advisable to omit or neglect everything that even in the worst case would be of but secondary importance.

To get handy and simple formulas for the reactions of beams having three supports it is not necessary to take into consideration each one of the immense variety of possible cases; it proves sufficient to consider the simplest possibilities, i. e., two loads only, first a load acting on a central span and secondly a load acting on the overhanging end.

For general conditions, then, we will have to find the reactions separately for each load, and figure out (for each support) the resultant reactions for all the loads combined. Without this restriction it would be impossible to treat the subject in a simple way or to give tables for facilitating computation; on the other hand, with this restriction the solution becomes easy and always allows a check on the results already obtained.

The first case is represented in Fig. 1. The load P_1, located between supports A and B, is acting downward. The assumed line of deflection, shown by dotted line, would require that reactions A_1 and B_1 act upward, or opposite to P_1, while C_1 acts downward. These directions of the reactions will be taken as positive.

The values of the reactions are:

$$A_1 = P_1\left\{\frac{\frac{u_1^2}{2}(3-u_1)+\frac{L_1}{L_1}u_1}{1+\frac{L_1}{L_2}}\right\}$$

$$B_1 = P_1\left\{\frac{-\frac{u_1^2}{2}(3-u_1)+\frac{L_2}{L_1}(1-u_1)+u_1}{\frac{L_2}{L_1}}\right\}$$

$$C_1 = P_1\left\{\frac{-\frac{u_1^2}{2}(3-u_1)+u_1}{\frac{L_2}{L_1}\left(1+\frac{L_1}{L_1}\right)}\right\}$$

where $u_1 = \frac{l_1}{L_1}$

The principles used in deriving the formulas are: The algebraic sum of all forces acting on the beam equals zero; the moments of the external forces around any point equal zero; the deflection of the beam at support A caused by all forces except A (i. e., if this support were omitted), is exactly as great as the deflection caused by A alone, but in opposite direction. The same principle holds good for the other reactions.

Should the load P_2 be applied on the other central span, as shown in Fig. 2, the position of P_2 relative to C_2 being the same as that of P_1 relative to A_1 in Fig. 1, the value of C_2 will be the same as A_1. The formulas given above are to be used accordingly.

The other case with which we have to deal is a load applied on the overhanging end as shown in Fig. 3. By the same principles as used above we find the following values for the reactions:

$$A_3 = P_3 - \frac{u_3}{2\frac{L_1}{L_2}\left(1+\frac{L_1}{L_2}\right)}$$

$$C_3 = P_3\left\{1+u_3\left(1+\frac{1}{2\left(1+\frac{L_1}{L_2}\right)}\right)\right\}$$

$$B_3 = P_3\,u_3\left(1+\frac{L_2}{2L_1}\right)$$

where $u_3 = \frac{l_3}{L_2}$

From the formulas given it may be seen that the values of the reactions may be calculated for various values of $\frac{L_1}{L_2}$ and u_1 (or u_3), and tabulated, provided P_1 or P_3 is taken as unity. Such a table has been calculated by the author and is given herewith. (Tables I. and II.)

The numerical value of each reaction in a given case is then found by multiplying the actual load with its corresponding value given in the table.

In each actual problem, where several forces are involved, attention must be paid to the direction of loads and reactions. If all the loads act in the same plane, their separate reactions at each support are to be added or subtracted, as the direction of the components may require. If the loads act in different planes, it is best to resolve each into horizontal and vertical components, find the reaction separately for each component load, compute the moment for each component at the desired point of the beam, add the individual horizontal moments and the vertical moments, and combine the two sums by the parallelogram of forces. If there is also torsional moment, combine this moment with the bending moment, and therefrom determine the dimensions of the beam or shaft.

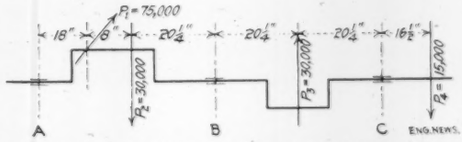
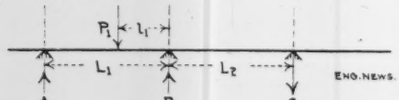


Fig. 4. Loading of Crank-Shaft of 14 x 28 Duplex Ammonia Compressor with Overhung Flywheel.

*Foot of East 138th st, New York, N. Y.

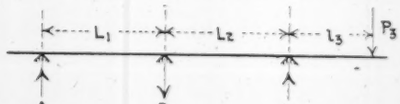
TABLE I.—LOAD BETWEEN SUPPORTS.



$u_1 = \frac{l_1}{L_1}$

	$\frac{L_1}{L_2}=\frac{1}{2}$			$\frac{L_1}{L_2}=1$			$\frac{L_1}{L_2}=2$		
	A_1	B_1	C_1	A_1	B_1	C_1	A_1	B_1	C_1
$u_1=1$	1.0	0	0	1.0	0	0	1.0	0	0
0.9	.8835	.12475	.00825	.87525	.1495	.02475	.867	.199	.066
0.8	.768	.248	.016	.752	.296	.048	.736	.392	.128
0.7	.6545	.36825	.02275	.63175	.4365	.06825	.609	.573	.182
0.6	.544	.484	.028	.516	.568	.084	.488	.736	.224
0.5	.4375	.59375	.03125	.40625	.6875	.09375	.375	.875	.25
0.4	.336	.696	.032	.304	.792	.096	.272	.984	.256
0.3	.2405	.78925	.02975	.21075	.8785	.08925	.181	1.057	.238
0.2	.152	.872	.024	.128	.944	.072	.104	1.088	.192
0.1	.0715	.94275	.01425	.05725	.9855	.04275	.043	1.071	.114
0.0	0	1.0	0	0	1.0	0	0	1.0	0
0.42265			.032075			.096275			.2566
0.1835								1.08806	

TABLE II.—LOAD ON OVERHANGING END.



$u_3 = \frac{l_3}{L_2}$

	$\frac{L_1}{L_2}=\frac{1}{2}$			$\frac{L_1}{L_2}=1$			$\frac{L_1}{L_2}=2$		
	A_3	B_3	C_3	A_3	B_3	C_3	A_3	B_3	C_3
$u_3=1$	.6666	2.0	2.3333	.25	1.5	2.25	.0833	1.25	2.1666
0.9	.6	1.8	2.2	.225	1.35	2.125	.075	1.125	2.05
0.8	.5333	1.6	2.0666	.2	1.2	2.0	.0666	1.0	1.9333
0.7	.4666	1.4	1.9333	.175	1.05	1.875	.05833	.875	1.8166
0.6	.4	1.2	1.8	.15	.9	1.75	.05	.75	1.7
0.5	.3333	1.0	1.6666	.125	.75	1.625	.04166	.625	1.5833
0.4	.2666	.8	1.5333	.1	.6	1.5	.0333	.5	1.4666
0.3	.2	.6	1.4	.075	.45	1.375	.025	.375	1.35
0.2	.1333	.4	1.2666	.05	.3	1.25	.01666	.25	1.2333
0.1	.0666	.2	1.1333	.025	.15	1.125	.00833	.125	1.1166
0.0	0	0	1.0	0	0	1.0	0	0	1.0

To make the application of the tables and formulas clearer let us take an example.

Fig. 4 shows the shaft of a vertical duplex 14 × 28-in. ammonia compressor driven by a horizontal 28 × 28-in. steam engine; the steam and one compressor work on the same pin, the other forms an angle of about 160° with the steam crank. The crank-pin pressure of the steam engine amounts to 75,000 lbs., that of each compressor cylinder to 30,000 lbs., and the flywheel, located outside of the bearings, as shown, weighs 15,000 lbs.

The values of $u = l \div L$ for the several forces are:

$$u_1 = \frac{8 + 20\frac{1}{4}}{18 + 8 + 20\frac{1}{4}} = \frac{28\frac{1}{4}}{46\frac{1}{4}} = 0.61$$

$$u_2 = \frac{20\frac{1}{4}}{46\frac{1}{4}} = 0.44$$

$$u_3 = \frac{20\frac{1}{4}}{40\frac{1}{4}} = 0.50$$

$$u_4 = \frac{16\frac{1}{2}}{40\frac{1}{4}} = 0.41$$

$$\frac{L_1}{L_2} = \frac{46\frac{1}{4}}{40\frac{1}{4}} = 1.142 \text{ and } \frac{L_2}{L_1} = 0.8754$$

for P_3 the value of $\frac{L_1}{L_2}$ is the same as $\frac{L_2}{L_1}$ for P_1 and P_2, that is 0.8754.

Let us find the reactions of the horizontal force first. The exact values corresponding to $u_1 = 0.61$ and $\frac{L_1}{L_2} = 1.142$, not being given in the table, have to be found by interpolation as follows: for

	$\frac{L_1}{L_2} = 1$	$\frac{L_1}{L_2} = 2$
$u_1 = 0.7$	$a = 0.63175\ P_1$	$A = 0.609\ P_1$
$u_1 = 0.6$	$a = 0.516\ P_1$	$A = 0.488\ P_1$
difference	$0.11575\ P_1$	$0.121\ P_1$
or $0.61 - 0.6 = 0.01$	$0.011575\ P_1$	$0.0121\ P_1$
for $u_1 = 0.61$	$A = 0.527575\ P_1$	$A = 0.5001\ P_1$

Difference $0.0275\ P_1$
Proportion for $0.142 = 0.004\ P_1$
$A = 0.52757 - 0.004 = 0.5236\ P_1$.

The same reaction by the formula would be:

$$A_1 = P_1 \frac{\frac{u_1^2}{2}(3 - u_1) + \frac{L_2}{L_1} u_1}{1 + \frac{L_2}{L_1}} =$$

$$P_1 \frac{\frac{0.61^2}{2}(3 - 0.61) + 0.8754 \times 0.61}{1 + 0.8754} = 0.5218\ P_1$$

which differs only 0.4% from the interpolated value.

If the shaft is considered as two separate beams, being cut at support B, the resulting reaction would be $A = 0.61\ P_1$, differing about 18% from the true value.

Proceeding in this way we find the following values for the reactions:

VALUE OF REACTION, POUNDS.

	A		B		C	
	From table.	Common rule.	From table.	Common rule.	From table.	Common rule.
For load P_1 (75,000 lbs.)	39300 (left)	45750 (left)	43100 (left)	29200 (left)	7400 (right)	0
For load P_2 (30,000 lbs.)	10200 (up)	13200 (up)	23200 (up)	16900 (up)	3400 (down)	0
For load P_3 [a] (30,000 lbs.)	2400 (up)	0	20000 (down)	15000 (down)	12400 (down)	15000 (down)
For load P_4 [b] (15,000 lbs.)	1380 (up)	0	8800 (down)	6100 (down)	22500 (up)	21100 (up)
Max. value of reactions (vertical)	14000	13200	32000	23000	38300	36100
Max. value of vert. and horiz. combined	41700	47600	53700	37200	39000	36100
Error of common rule		13%		44%		8%

[a] Use C for A, A for C, in Table I.
[b] Use Table II.

The reaction A becomes maximum for the distribution of loads shown in Fig. 4; B is maximum during the suction stroke in compressor located between B and C when P_2 acts upward; and C if P_3 points down and P_2 up.

From the resultant reactions it may be seen that the middle bearing, if proportioned for a load of 37,200 lbs., would actually be subjected to stresses about 50% higher than permissible. This may account, perhaps, for the fact that builders of shafts having three supports experience so much trouble with their middle bearings, which can be remedied only by lowering this bearing until the remaining pressure will not cause excessive heating. The outboard bearings usually being of ample size will take this additional load without difficulty.

Without going into any further details of this example, it will be evident (1) that the old method used for shafts of more than two supports is not reliable, and (2) that the pressure on the central bearing is always greater than usually assumed (according to the tables it may be even greater than the load itself).

A STEEL VIADUCT WITH CONCRETE CASING AND FLOOR.

In all steel bridges erected over railway tracks the protection against corrosion is a matter of special importance, affecting the life and the cost of maintenance of the structure. A six-span bridge or viaduct for foot passengers now being erected across railway tracks at Cedar Rapids, Ia., is of interesting design in three particular respects: (1) the steel trusses are entirely encased in concrete to protect them from the corrosive effects of smoke and gases from the locomotives; (2) the floor is a continuous concrete slab carried by the bottom flanges of the trusses; (3) there are no expansion joints in the entire length of 341 ft. between abutments. There is a 31-ft. span on skew piers at the middle, flanked on one side by two 62-ft. spans and on the other side by three 62-ft. spans. The elevation, Fig. 1, shows three of the spans and also shows the general design of the trusses, while Fig. 2 is a cross section of the bridge. The structure is designed for a live load of 40 lbs. per sq. ft.

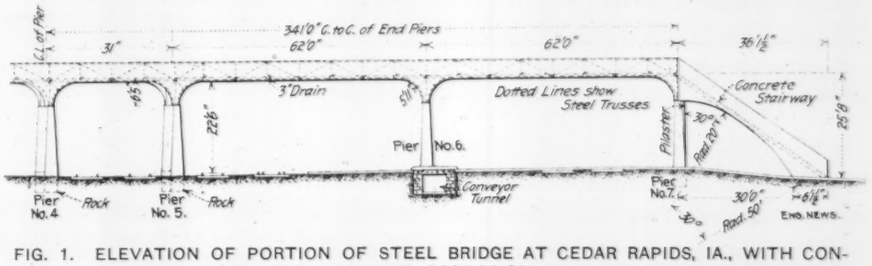
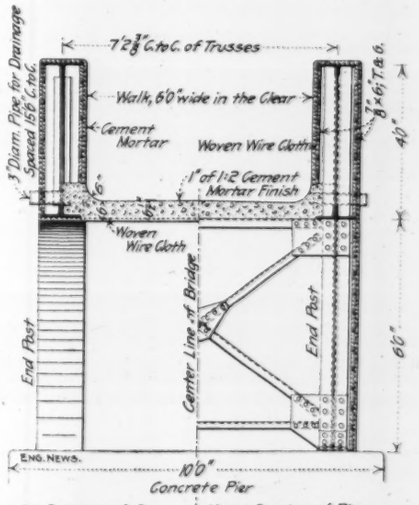


FIG. 1. ELEVATION OF PORTION OF STEEL BRIDGE AT CEDAR RAPIDS, IA., WITH CONCRETE PROTECTION AGAINST CORROSION FROM LOCOMOTIVE GASES.

The trusses are built up entirely of angle irons; 6 × 3½ ins. for the chords, 3 × 2½ ins. for the web members and 4 × 3 ins. for the vertical posts resting upon the piers. Beneath the floor, these posts are connected by transverse bracing. The trusses and posts are encased in a sheathing of ⅞-in. tongued and grooved planks, 6 ins. wide, the planks being nailed to vertical posts fitted between the flanges of the trusses. Over this sheathing is laid a wire netting or wire lath, with No. 18 wires and 2½ meshes to the inch, the netting being kept slightly away from the face by means of lathing. Upon this sheathing Portland cement mortar is then applied to a thickness of 1 in., the netting being entirely embedded within it. This mortar is a mixture of 1 cement and 2 sand, stiff enough to remain in place, and after it has thoroughly set it is given two coats of cement grout. The floor is a continuous concrete slab, and with the horizontal steel bracing in the floor system, it forms a restrained concrete slab, or transverse flat arch. It is 12 ins. deep where it rests on the trusses, 6 ins. at the sides and 6½ ins. at the center. Drains of 3-in. iron pipe are embedded in the concrete, about 15 ft. 6 ins. apart, and extend beyond the outer face of the concrete covering. The concrete floor is composed of 1 part Portland cement, 2½ of sand and 5 of broken stone, and has a 1-in. finish of 1:2 cement mortar. It is reinforced by a sheet of wire netting similar to that used in the sheathing, and laid close to the lower face of the slab; while the netting of the inside sheathing is carried down so as to be embedded in the floor. The forms for the floor will be suspended from the trusses.

The piers are of concrete, 1:3:5½, and are not reinforced. One of the piers is located over a rectangular tunnel for the conveyor system of a plant of the American Cereal Co., as shown in Fig. 1. Across the roof of the tunnel are laid ten 7-in. I-beams, 10 ft. long, and these are embedded in 12 ins. of concrete forming a base 11 ft. square, upon which the pier rests. The abutments are reinforced-concrete approach stairways independent of the end piers; the ribs of the abutment (forming the side walls of the stairway) rest upon pilasters projecting from the face of the pier. The steps have a 7-in. riser and 10-in. tread. The concrete for the abutments is a 1:2½:5 mixture, reinforced by ⅞-in. plain round rods of medium open hearth steel and by sheets of wire netting. In the end face of each side wall is a V-shaped vertical groove, engaging with a rib in the face of the end of the bridge wall, thus forming an expansion joint between the superstructure and the abutment.

The numerous tracks of the Chicago & Northwestern Ry., Chicago, Rock Island & Pacific Ry. and Chicago, Milwaukee & St. Paul Ry. were formerly crossed at grade at this point by C Ave., but the city has closed the crossing and required the railway companies to erect a foot-



At Center of Span. | Near Center of Pier.

Fig. 2. Cross-Section of Cedar Rapids Bridge, Showing Concrete Protection Against Corrosion.

bridge in its place. The railways, acting jointly, engaged Mr. J. W. Schaub, M. Am. Soc. C. E., of Chicago, to design the bridge, and the adopted design (now under construction) embodies the features of low first cost and low cost of maintenance, the latter due to the protection of the steel work against corrosion. The general contractors are Bartlett & Kling, of Cedar Rapids, Ia., and the steel work was built by the Morava Construction Co., of Chicago. The work was let complete for about $7,500.

THE TRANSPORTER BRIDGE AT NEWPORT, ENGLAND.*

Another example of the "transporter bridge" or "ferry bridge," has just been completed and opened for traffic at Newport, England, over the River Usk, after nearly four years spent in construction. As seen by Fig. 1, the structure is of great height, the top of the suspension towers rising nearly 270 ft. above the water. Their foundations had to be carried to a depth of about 80 ft. The floor of the bridge, from which the traveling car is suspended, is 170 ft. above the water.

Fig. 2 shows the general arrangement of the towers. Open lattice steel construction is used.

On the top of each masonry pier a heavy cast-iron saddle is fixed. This saddle carries a rocker pin on which rests an inverted saddle connected to the tower leg itself.

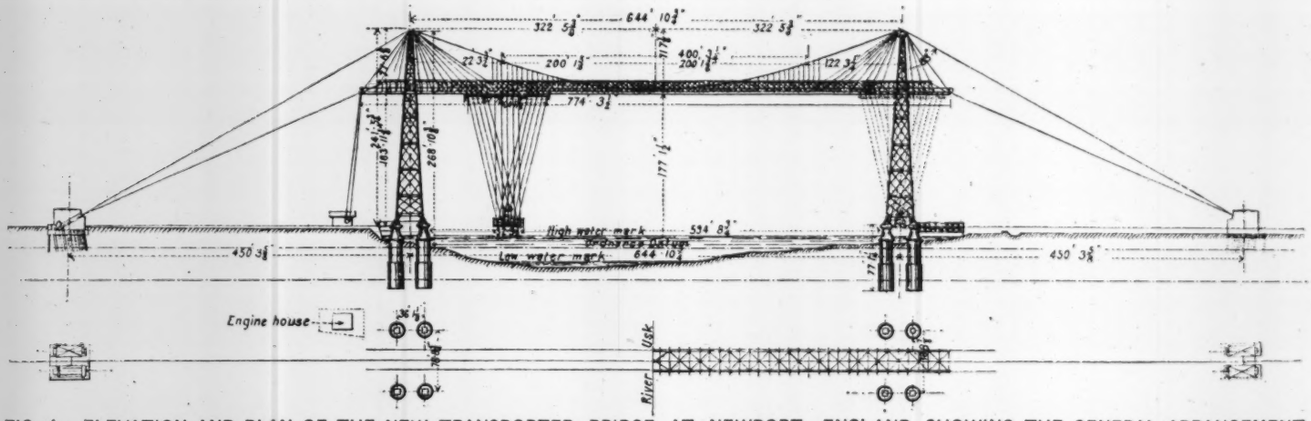


FIG. 1. ELEVATION AND PLAN OF THE NEW TRANSPORTER BRIDGE AT NEWPORT, ENGLAND, SHOWING THE GENERAL ARRANGEMENT OF THE STRUCTURE AND ITS PRINCIPAL DIMENSIONS.

Each leg is secured to its spindle by steel shackles, and each spindle, in turn, is secured to the masonry pier by steel bolts and clips.

A wind pressure of 56 lbs. per sq. ft. on the side facing the wind, with one-half this amount on each of the leeward faces, has been allowed for in the calculations; four faces are therefore taken into account. One-half the area is allowed for the leeward faces. The stability of the tower against overturning is at a minimum when it is standing as an isolated structure, the static load due to the weight of the suspended structure and platform increasing its stability very considerably, although the actual work required of the tower in this case is greater, as the effort due to wind pressure on the suspension, the stiffening girder, and the traveling car reacts on the tower. Each tower is provided with an easy stairway extending from the ground to the platform level. The total stress to which the steel is subjected by wind pressure is 6.28 tons per sq. in. Each tower weighs 277 tons, and the surface to be painted is 36,000 sq. ft.

Sixteen suspension cables are used—four inside and four outside of the stiffening trusses. Each cable is composed of 127 wires 21.7 mm. in area, the section of each cable being 4.273 sq. ins. Under the maximum load the tension in the parabolic cables is 12.27 tons, and in the anchor cables 12.69 tons per sq. in. In common with all other main cables used in the bridge, these cables are finished at their ends with steel sockets, which are connected to the main saddle pins of the expansion carriages by steel shackles, and to the anchor castings by steel bolts, this arrangement providing for the accurate adjustment of the cables to their work, and permitting of their renewal in detail without interfering with the working of the bridge. A portion of the span is carried by diagonal or oblique cables proportioned to the work they have to perform.

The stiffening trusses are spaced 26 ft. 3 ins. apart, and are 16 ft. in depth.

The traveling frame, Fig. 3, is built up of joist channel and angle sections, and is arranged to run under the bottom booms of the stiffening girders. It is provided with 60 wheels, 15 inside and 15 outside the web of each of the rail-carrying members. The wheels are of cast-steel, carried in steel brackets secured to the longitudinal members of the frame. In addition, each bracket has two horizontal wheels engaging on the edge of the flange plate. The whole of the brackets and wheels are interchangeable. The frame is 104 ft. in length over all.

The platform, or car, suspended from the traveling frame, is shown in Fig. 4. It is 33 ft. in length by 40 ft. in width. The car is divided into a central roadway space and two footways. The thirty suspension ropes are attached to the car and frame in such a manner as to form a triangulation both in longitudinal and transverse directions, so as to prevent swaying during high winds. The tension load in the cables is 12.7 tons per sq. in. Each beam is calculated for the simultaneous passage of two four-wheeled vehicles, each carrying 7½ tons on an axle, a moving load of 62 lbs. per sq. ft. being allowed for in the footways. The traveling frame and service platform weigh 16.3 tons; the suspension cables, 2.9 tons; the car, 31.5 tons; or a total of 50.7 tons. The frame and car are propelled by steel wire ropes wound on a drum worked by two electric motors, each of 35 B. HP., erected in a steel-framed building placed over the approach road at the eastern end of the bridge.

The electrical control is operated by series controllers worked from the pilot house. Insulated conductors connecting the control apparatus extend from the pilot house to the traveling frame, where they are joined up to underrunning trolleys, engaging on the trolley wires slung below the bridge platform, these wires in turn being joined up by insulated conductors carried down the eastern tower to the switchboard in the motor house.

An elastic or movable buffer, Fig. 5, is placed at each riverward face of the fixed structure so as to absorb the momentum of the car and prevent shock. The maximum rate of travel is 10 ft. per second, and the bridge has successfully withstood a working test of 120 tons.

*The first bridge of this type, invented and patented by F. Arnodin, of France, was built at Rouen, France, and similar bridges have also been built in Spain. The only example in this country is the Duluth ship canal bridge, illustrated and described in Engineering News of March 20, 1902, Dec. 15, 1904, and May 25, 1905.

NEW SHOPS OF THE CINCINNATI, HAMILTON & DAYTON RY. AT IVORYDALE, O.

The Cincinnati, Hamilton & Dayton Ry. has recently put in service its new repair shops at Ivorydale, seven miles from Cincinnati; these shops are intended for light repair work only, all heavy work being done at the main shops at Lima, Ohio. The main buildings are the rectangular engine house 254 × 90 ft., and the repair shop, 201 × 123 ft., separated by a transfer table pit 70 ft. wide and 327 ft. long. The repair shop has boiler, machine, erecting and light repair departments, and a wing contains the blacksmith shop and power-house. Adjacent to the shops is the freight car repair yard. The plant was designed by the Arnold Co., of Chicago, in accordance with the general plans of the railway company, and the designs were approved by Mr. C. A. Wilson, Chief Engineer, and Mr. A. C. Hinckley, Master Mechanic. The construction contract was awarded to the Arnold Co. in July, 1905, and the plant was completed by January, 1906. The special features of the plant are the adoption of the rectangular type of engine house and the use of fireproof construction for the buildings. The following particulars are taken from a descriptive bulletin recently issued by the builders:

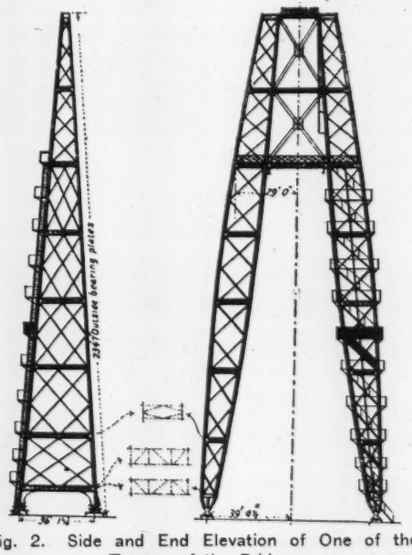


Fig. 2. Side and End Elevation of One of the Towers of the Bridge.

The engine house is 254 × 90 ft., with 14 pits spaced 18 ft. c. to c. It is of reinforced concrete with hollow partition tile, the Kahn system of reinforcement being used for the beams and roof slabs, while 9-in. brick curtain walls (pierced with windows) are built between the outer columns. A 4-in. veneer of brick also covers the columns and outside beams, and forms the pilasters and corbel courses. The roof slabs between the girders consist of concrete beams 16 ins. c. to c. and hollow partition tile. There are three spans of 29 ft. 4 ins. c. to c. of columns, with a height of 21 ft. 2 ins. at the walls and 25 ft. 9 ins. in the middle span, the latter forming a clerestory roof. Light is provided by windows in the walls and clerestory and by arc lamps over the pits. The building is heated by hot air forced through a system of conduits to the engine pits by means of a fan. The Dickinson vitribestos smoke jacks (of light but incombustible material) are placed over the ends of the pits. Steam and water piping is provided.

The main repair shop is 201 × 123 ft., with nine tracks 22 ft. c. to c., and is of steel and brick construction. Two tracks with drop-pits are for light repairs; one (without a pit) is for boiler repairs and can take two engines; five have standard pits, and the last has a drop-table, as the shop is not fitted with an overhead traveling crane. The store house and office building, 104 × 32 ft., is of brick and timber construction, two stories high. The oil house has columns, roof and floor of reinforced concrete construction, with 9-in. curtain walls and a brick veneer over the outside columns and girders. It is one story high, with a basement for the storage tanks. There is also a woodworking shop, of brick and timber construction, for light car repair work.

The plant has a complete water supply and drainage system, and a system of industrial railways of 24-in. gage. Where these tracks are parallel with standard gage tracks, only one extra rail is used. The machinery is operated by electric motors, the 240-volt current for which is generated by two direct-current generators of 62½-KW. capacity, directly connected to engines of 100 HP. running at 275 r. p. m. A few of the heavier machines have individual motors, but the lighter tools are belted to shafting driven by motors. The 70-ft. transfer table is designed to

handle a locomotive weighing (with tender) 177 tons, and has a speed of 150 ft. per min. with the load. There are two motors for propelling the table and a third motor operates a drum with cable for hauling cars on and off the table. The drop table in the machine shop is 40 ft. long, designed to carry 50,000 lbs. on each of four axles 5 ft. c. to c. It is supported by four lifting screws operated by a motor, and has two speeds; the full load can be handled at 6 ins. per min., while a 20-ton load can be handled at 24 ins. per min.

On the subject of organization for construction the bulletin already mentioned may be quoted from as follows:

ORGANIZATION FOR CONSTRUCTION.—As the Ivorydale plant is a fair example of a proposition handled entirely through both the stages of engineering and construction work by one concern, the description of the methods by which this is accomplished, both in the office and field, may be of interest. The Arnold Co. was instructed by the railway officials to prepare a detailed report upon the capacity of the buildings and the facilities to be provided. This was done after a preliminary study had been made by the railway officials. As a basis upon which to work, the company was furnished with a plan of the ground available, together with information regarding the number of locomotives and cars to be handled at this division point and the relation of their operation to that of the complete system.

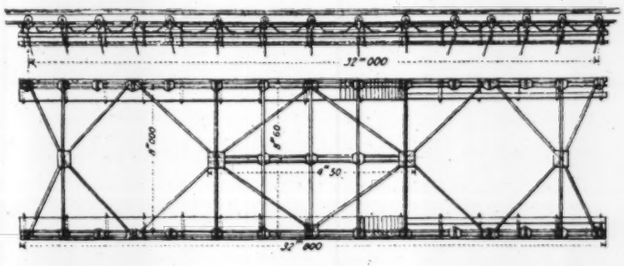


FIG. 3. ELEVATION AND PLAN OF THE TRAVELING FRAME.

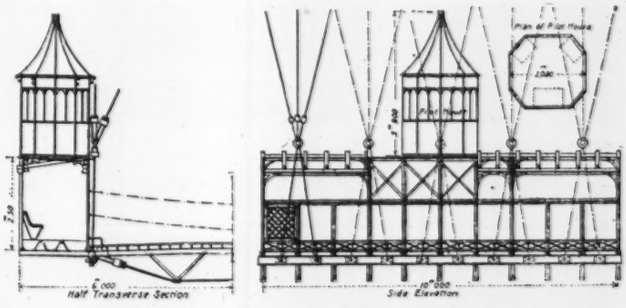


FIG. 4. CAR USED ON THE TRANSPORTER BRIDGE.

As is often the case in connection with railway shop construction, the amount of money provided for the improvement was found by the engineering department to be somewhat limited. This made it necessary to omit some of the more improved machinery. In other words, it became necessary to work with a fixed sum of money somewhat less than might be wished, and this necessity resulted in the adoption of certain special provisions for making running repairs on locomotives and for taking care of bad order cars. With due consideration to the above points, a block plan of the buildings and yards was prepared, providing the necessary capacity and also adapted to the physical peculiarities of the site. This plan, together with a description of the proposed improvements and accompanying estimate of cost, was presented to the officials of the railway company and their approval of the plans and estimates was obtained.

In preparing an outline of improvements and an estimate of costs a classification of the work was made which served not only for the estimates but for all correspondence, requisitions, accounts, progress of work and completed costs. This classification covered all the material and work proposed in the improvement and served not only to guard against omissions in any part of the equipment at the time the estimate was made, but also to keep the records of the progress of the work complete under each section of the classification. Detailed specifications were drawn for each part of the plant and bids were received from outside sources upon the work, but the estimate which was furnished by the Arnold Co. with the completed plans and specifications, and intended to represent the cost of the completed construction work, closely conformed to the consistent bids.

The rapid and efficient construction of the Ivorydale shops is due in no small measure to a few simple and direct principles governing the relation between the main and the construction offices. The construction office is advised as to the material ordered and as to the delivery of this material. The home office is advised as to the receipt of material on the job as well as to the progress of the construction work and any reports and advices as to the labor situation. To accomplish the former, copies of contracts for apparatus and orders for material are sent to the superintendent in charge of construction. Such reports and orders contain exact information as to the material covered by them as well as to the time at which this material is expected to arrive on the work. A card system, in which are entered all orders and contracts, is used in the home office and is designed to follow up and secure prompt delivery of all material and apparatus. In case of any changes in time of delivery of material, the construction superintendent is advised in advance, and is thus in position to make any changes necessary in his program. The importance of promptly delivering the material on the job cannot be overestimated, and the value of a system that will provide for the delivery of the materials on the job in accordance with an approximate schedule previously arranged for will appeal to all interested in construction work.

Practically all of the material is ordered by the home office. In case, however, it is more advantageous to order small quantities at the work, such orders are issued by the superintendent, a copy of all such orders being sent to the home office, after which they are recorded and handled in all respects similar to orders issued from the office. Records of all material received on the job are kept by the superintendent in the form of a material report. These reports are written out in a duplicate book, as each shipment is received, and one copy is sent without delay to the main office. This serves to keep the home office very closely in touch, so far as the receipt of material is concerned.

In construction work consisting of a great many items, such as in railway shops, it is very desirable to know with a fair degree of accuracy the exact progress of the work. Certain lines of the work such as the delivery and installation of machinery are dependent upon the progress of other work such as the completion of the buildings and foundations. In order that such information may be always at hand, progress reports from the work are received at stated intervals, usually two weeks apart, giving in detail the progress of the work under each classification head. This information is kept in form for convenient reference and is useful in a variety of ways. Not only does it keep the engineering force in touch with the progress of the work, making it possible to more efficiently make such provision as will insure the work coming in proper sequence, but also provides the information necessary to make decisions as to changes in detail, in case such are found necessary after the work has been begun. These progress reports, together with a record of moneys expended for material and labor at any date, give timely information as to the actual cost of the work as compared to the estimated cost. As such reports are made on the work under each classification heading any variation of the cost from the estimate is at once detected. This is of importance to the contractor who proposes to complete a certain improvement within a definite estimated cost.

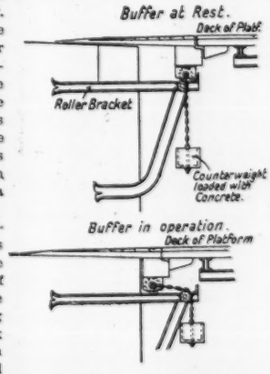


Fig. 5. One of the Buffers Placed on the Bridge to Absorb the Momentum of the Car and Prevent Shock.

Wherever it is possible curves or diagrams are used to represent the condition of affairs of which record is to be kept. A chart showing the progress of the work on building construction is easily made and shows very clearly the exact condition of the work at any time. At the end of each two-week period the total expense incurred during the two weeks previous is plotted under each classification head, and this area on the chart indicated in such a way as to designate the progress made during the particular period in question. A glance at the chart will show the total amount completed under each classification represented on the chart at the time the last entry was made, as well as the amount of work that was done under the various classifications during each period considered. Other curves give in graphical form a record of the number of workmen employed on the work at all times, together with information as to the number of carloads of material received, the weather conditions and other matters of interest. Progress photographs are taken of the work at stated intervals, in the case of the Ivorydale shops about two weeks apart. These show at a glance not only the general progress of the work, but many construction details as well which are of interest and value. These photographs are of standard size and mounted on cloth so as to be bound in convenient form for reference. All the reports referred to: the progress reports, charts and diagrams, while very easily obtained and requiring but little work in their preparation, supply a great deal of valuable information, and are well worth the trouble and expense in securing them.

Although every facility is provided for keeping the main office and the construction office in close touch, it should not be understood that plans and specifications are devised and completed by an engineering force in the office to be sent down to the construction superintendent on the job for his execution. A competent engineer is in charge of all construction work, and spends a certain amount of time in the field, thus putting him in close touch with the situation and enabling him to more efficiently direct the detailed engineering work that is done in the main office.

RESULTS OBTAINED WITH THE KJELLIN ELECTRIC STEEL FURNACE.*

By E. C. Ibbotson.†

At Gysinge, in Sweden, during the year ending May 31, 1906, from a fixed furnace giving 1 ton (2,240 lbs.) of steel per tap, there were produced 950 tons of tool steel and special steel ingots.

In carbon and iron tool steels all the usual tempers were made. The bulk of this steel was made from charges composed of about 80% of Swedish white pig iron and 20% of steel scrap. The percentage of carbon was regulated by the addition of briquettes. Other charges were made from Swedish white iron and steel scrap.

The average time taken per charge, for the year, when adding briquettes, was 7½ hrs., and the electric energy consumed was 1,128 KW.-hrs. per ton. The average time per charge for white iron and scrap charges was 5½ hrs., and the electric energy consumed was 886 KW.-hrs. per ton. These consumptions include all time and energy lost from various causes, such as bad water supply, ice, etc.

It is quite ordinary practice to complete the charges with briquettes in 6½ hrs., and without briquettes in 5 hrs.

The lining of this furnace during the year was magnesite. When using briquettes the lining lasts, on an average, five weeks, and when charges are worked without briquettes the average life of the lining is seven weeks.

Various tests have been made of the steels produced in this furnace, and many have been given in previous reports. During the year satisfactory results obtained in works practice have been reported, particularly in connection with the following steels: Stamping dies, punches, cold chisels, screwing dies and taps, cutlery, drills and turning tools. The following special steels have also been produced: Tungsten steel (including permanent magnet steel), chromium steel, nickel steel, nickel-chromium steel, self-hardening steel and high-speed tool steel. High-speed tool steel, tested to one of the latest Government specifications, gave satisfactory results, while 25% unannealed 2-in. nickel steel bar, ¼-in. in diameter, gave a yield point of 30.68 tons per sq. in., a maximum stress of 50.44 tons per sq. in., an elongation of 44%, and a reduction of area of 60%.

Electrical tests carried out have shown that No. 6 gage rods had a specific resistance of 36 microhms per cu. in., and No. 16 gage wire a specific resistance of 33.5 microhms per cu. in.

*Abstract of a paper read at a recent meeting of the Iron and Steel Institute.

†Sheffield.

GROUTING A LEAKY TUNNEL ON THE PARIS, LYONS & MEDITERRANEAN RY.

The Limonest Tunnel on the Paris, Lyons & Mediterranean Ry. is 3,165 ft. long, driven in a hard granite underlying a clayey water-bearing stratum. The arch lies in this latter stratum, and in construction it was waterproofed only by layers of tarred sheets. Drains 6.56 ft. apart collected the water falling upon the arch and conducted it to the lower part of the sides, where weep-holes were formed to discharge it into the tunnel. At the time that repairs were undertaken, in 1905, the arch had been cracked and injured in several places. It was, therefore, necessary to strengthen the arch, to renew the weakened mortar, to check leaks, and to fill the voids above the arch.

The method adopted was to pump cement grout through holes in the arch. The apparatus employed consisted of a steam engine operating an air compressor, and two closed horizontal cylindrical pressure tanks, in which the grout was placed alternately. A shaft fitted with blades revolved in each tank, thus keeping the grout well stirred up, while the compressed air forced it through a flexible pipe having a nozzle to be adjusted to holes drilled in the masonry arch. The grout was prepared before being put into the tanks. A timber traveler was built for this repair work, 21½ ft. long, and with two decks, as shown in Figs. 1 and 2. This was mounted on four pair of wheels running on a temporary narrow gage track. On the lower deck were two tilting hoppers in which the grout was mixed; it was then discharged through a hopper and pipe into the agitators or pressure tanks below. The upper deck, 6.56 ft. above the first, was for the use of the men in drilling the holes and using the grouting pipe.

The grouting holes were arranged as shown in Fig. 2, five at each station. The grout was first injected at hole No. 1; when the grout appeared at hole No. 4, the nozzle was transferred to No. 2, and then to Nos. 3 and 4. The final grouting was done at hole No. 5 in the crown of the arch, and should have been continued up to the full pressure available, but owing to overflow or choking the grout was held back before this pressure was attained. The work at one station or series of holes being completed, the traveler was pushed forward 16.40 ft. to the next station. Contrary to instructions and acting on bad judgment, the contractor commenced work at the crown of the arch. This proved to be a mistake; the cement flowed over the haunches in a thin film, making them temporarily watertight, but preventing later injections from penetrating into the joints and making the work solid.

The mixture varied from 1 cement to 2 water, to 1 to 1, but the latter was adopted as most satisfactory; in some cases it was as high as 1½ to 1, but experience showed that this was the highest that could be used to advantage. It was also found that where the mortar of the masonry had been diluted and partly washed away by the water, it was necessary to add sand to the grout to make it less fluid. The sand should be clean and screened through sieves of fine mesh, so that the material used will be very finely divided and will not injure the injection apparatus. It was thought at first that the use of sand would interfere with the operation of the valves and also tend to clog the nozzles; in practice, however, no trouble was experienced; the addition of sand even facilitated the discharge of the grout. It was used in proportions as high as 1 to 5.

Several springs were encountered which caused considerable leakage. At these points the grouting was begun some distance back, in each direction, so as to form transverse dams to resist the pressure and retain the grout as the work approached nearer to the spring, the pressure of which made the grouting more and more difficult. It is probable that in many cases the grout simply spread over the extrados of the arch, the pressure of the water being higher than that attainable by the machine. At three points in the tunnel the attempt to close the springs had to be abandoned, leaving voids 5 ft. to 6 ft. long (lengthwise of the tunnel); here drains were cut behind the masonry for a width of 28 to 32 ins. and extending down to the springing line, where a weep-hole was made in the wall. Dry stone was packed into the voids, and the masonry rebuilt, the outer face being coated with quick-setting cement.

When the grout was injected, it was found to ooze from the hole and from all cracks at the joints; it also appeared at the old weep-holes, the drains serving to lead it directly to them. It was found necessary to stop these leaks of grout, and special men were engaged in watching for these escapes and closing the holes with plugs of clay or cement. Under high pressure the grout would sometimes appear at distances of 200 to 260 ft. from the injection hole.

The results have been satisfactory, but costly and tedious, the work continuing from April to August of 1905. All the weep-holes show water, but there is no leakage through the arch. The grouting covered an aggregate of 2,600 ft. in length of the tunnel. The total cost was about $47,700.

The above description is taken from an article by Mr. M. Beynet, Division Engineer of the Paris, Lyons & Mediterranean Ry., published in the "Revue Generale des Chemins de Fer." The great amount of cement and grout required in this case was due to the continuous character of the voids and openings. Mr. Beynet suggests that in new construction work of this kind it would be advisable to sectionalize these openings: (1) by making the drainage of the arch independent of that of the sides, by means of masonry filling behind the first three or four courses of the arch; (2) by forming bulkheads or transverse masonry rings 20 to 40 ins. thick, built in excavation above the extrados of the arch. These would form dams 65 to 100 ft. apart, and their positions would be indicated by marks on the

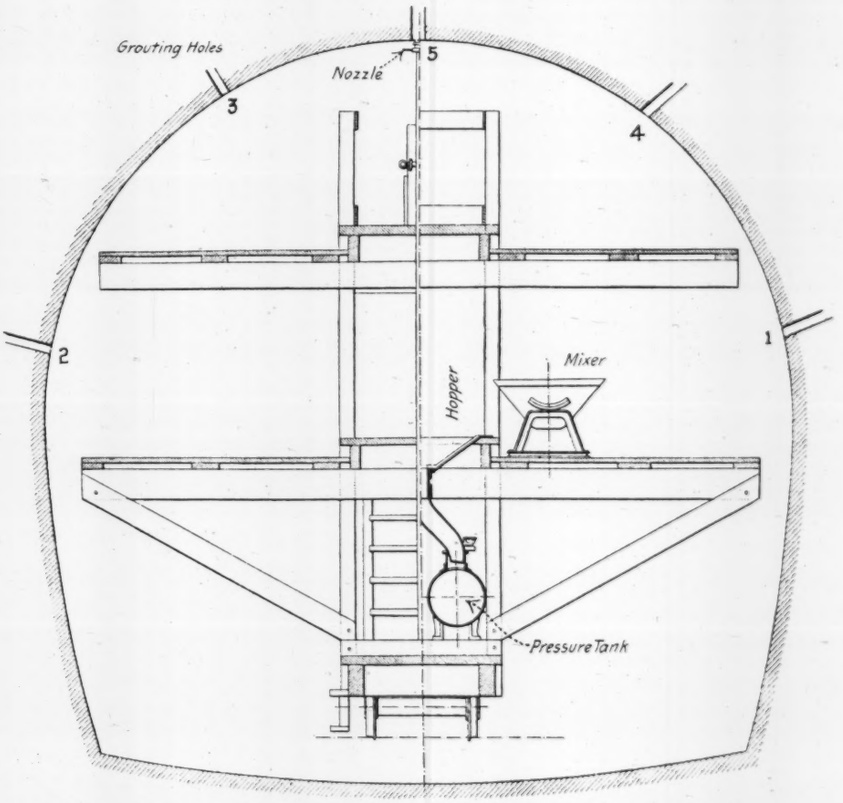


FIG. 2. CROSS SECTION OF TUNNEL SHOWING GROUTING APPARATUS.

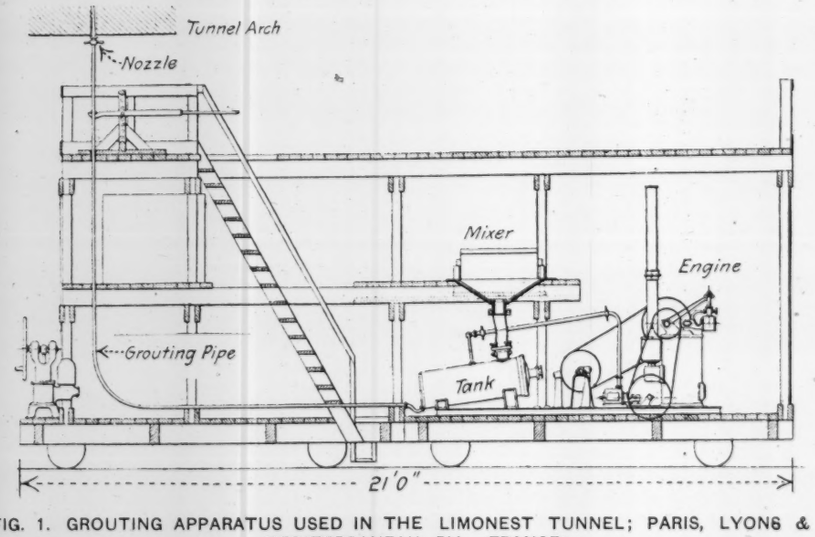


FIG. 1. GROUTING APPARATUS USED IN THE LIMONEST TUNNEL; PARIS, LYONS & MEDITERRANEAN RY. (FRANCE).

inside of the tunnel. Then in case of leakage or deterioration it would only be necessary to inject grout into the individual voids or chambers, and the grout could not escape in various directions.

This method of filling voids and consolidating masonry, etc., has been employed in a number of cases, including bridge foundations, the inverts of the locks at Havre, the Culmont tunnel on the Eastern Ry. of France, a cofferdam for bridge piers at Toulouse, many iron-lined "tube" tunnels, and the rock slide in the Murray Hill section of the New York subway. The late Robert L. Harris employed it in a number of cases, even for consolidating quicksand.

THE COST OF DEEP-WATER DREDGING WITH A CLAM-SHELL DREDGE FOR THE STONY POINT EXTENSION OF THE BUFFALO, N. Y., BREAKWATER.

By Emile Low,* M. Am. Soc. C. E.

In Engineering News of Sept. 20 there appeared a very interesting article, by Mr. Henry N. Babcock, M. Am. Soc. C. E., recording experience with the U. S hydraulic hopper dredges "Manhattan" and "Atlantic," employed upon Ambrose Channel, New York Harbor, in which it is demonstrated that the above mentioned channel can be dredged profitably with these vessels at 9 cts. per cu. yd.

It may be of interest to the profession to state the cost of the deep water dredging with a very large clam-shell dredge which was done some years ago on the Stony Point extension of the Buffalo, N. Y., breakwater.

The extension consists of two breakwaters, one 9,989 ft. long and the other 2,803 ft. long. The longer structure is made up of two parts, the rubble mound section (stone breakwater), 7,250 ft. long, and the timber crib section (South Harbor section), 2,739 ft. long.

The Stony Point timber crib breakwater, with the exception of a few hundred feet next the shore, stands upon an artificial foundation of sand and gravel, up to the level of the original lake bottom, this material having been back filled into a trench dredged practically to bedrock. At the outer end of the breakwater, where the water is over 22 ft. deep (also the maximum depth of the timber cribs), a rubble stone foundation is interposed between the bottom of the cribs and the top of the gravel filling.

The South Harbor timber breakwater also stands upon a similar artificial foundation, with the exception that the rubble stone foundation is almost uniformly 8 ft. high, the cribs resting directly upon this.

Under the original specifications contractors were permitted to use either hydraulic dredges or the clam-shell type.

The successful contractors, Hughes Bros. & Bangs, elected to excavate the trenches by means of a very large clam-shell dredge, built expressly for this work by the Osgood Dredge Co., of Albany, N. Y.

This dredge was illustrated and fully described in Engineering News of Feb. 2, 1899, while it was engaged on the Buffalo works. It may be noted here that the clam-shell bucket of this dredge has a capacity of 10 cu. yds. and weighed empty over 30,000 lbs. The hull of the dredge is 120 ft. long and 40 ft. broad, and a false stern increases the total length to 151 ft. The dredge had to excavate material from depths up to 70 ft., much of it solidly compacted. Most of the material dredged was a moderately stiff red clay, mixed with some blue clay. Overlying this clay was a layer of sand perhaps 1 or 2 ft. thick. Underlying the clay, next to the rock, was a layer of hard, blue clay, mixed with broken stone or gravel, and in places there were a good many large boulders.

The dredged material was generally transported to a dumping ground 10,000 ft. distant from the dredge, the time for the round trip being 1 hour and 6 minutes. Three steel scows were used to transport the excavated material.

The principal cause of delay was the sea and wind (about three-eighths of the total delays). Considerable delay was also due to the clam-shell bucket. Moving and placing the dredge was another large item of delay.

*Barge Canal Office, Rome, N. Y.

WORD DONE BY THE DREDGE "FIN MAC COOL" ON THE SOUTH HARBOR SECTION, BUFFALO, N. Y., BREAKWATER, DURING THE SEASON OF 1899.

Month.	Time worked. h.	m.	Time delayed. h.	m.	Number of days.	Length of day in hrs.	No. of scows loaded.	Average load of scows, in cu. yds.	Average No. of hrs. to load scow.	Material dredged, in cu. yds.	Cu. yds per hour worked.	Average hrs worked per day.	Av. daily delay, in hrs. due to sea.	Av. No. of cu. yds. per day.	Max. day's work, in cu. yds.	Maximum hrs' work, in cu. yds.
May	190	37	131	23	23	14	166	322.2	1.1	53,494	280.6	8.3	2.7	2,326	4,621	369
June	232	11	131	49	26	14	191	335.2	1.2	64,022	275.7	8.9	2.8	2,462	4,318	346
July	211	40	152	20	26	14	180	306.3	1.2	55,138	260.0	8.1	1.6	2,121	4,001	364
August	255	31	122	29	27	14	217	358.7	1.2	77,848	304.7	9.5	1.6	2,883	5,037	438
September	133	12	206	48	24	(14 (12	109	335.7	1.2	36,597	274.7	5.6	3.8	1,525	3,804	344
October	98	02	55	46	13	12	89	328.5	1.1	29,244	298.3	7.5	0.5	2,250	3,510	350
Total	1,121	13	800	35	139	..	952	332.3	1.18	316,343	282.1	8.0	2.3	2,263	5,037	438

NOTE.—Abnormal time of one day's work, 14 hours.

DETAILED STATEMENT OF DELAYS ON CLAM-SHELL DREDGE "FIN MAC COOL," SEASON OF 1899.

Item of delay.	May. h.	m.	June. h.	m.	July. h.	m.	August. h.	m.	September. h.	m.	October. h.	m.	Total. h.	m.
Hoist cables	11	23	3	33	1	45	4	16	1	42	2	14	24	53
Clam	6	46	5	30	27	15	6	16	32	07	23	46	101	40
Main engines	2	20	1	20	0	20	0	55	..	..	..	..	4	55
Boilers	0	25	0	30	..	..	..	..	..	..	0	10	1	05
Anchors and attachments	0	25	0	30	2	00	3	55	0	30	..	..	7	20
A frame and boom	..	..	4	00	1	45	0	30	..	..	..	..	6	15
Breakdowns, dredge	..	..	..	..	..	..	0	35	..	..	..	..	0	35
Leaking scows	0	20	0	35	..	..	0	10	..	..	..	..	1	05
Repairs, scows	1	46	..	..	6	47	5	43	..	..	0	35	14	51
Siphoning scows	0	20	..	..	0	47	1	46	0	54	..	..	3	47
Waiting for scows	4	08	0	40	9	01	9	45	4	15	2	05	29	54
Waiting for tugs	0	55	7	27	0	15	0	49	0	11	..	..	9	37
Meals	21	40	26	00	26	00	27	00	18	30	6	30	125	40
Rain and fog	..	..	..	..	..	..	3	00	..	..	1	15	4	15
Sea	61	10	73	03	42	47	42	30	92	05	6	00	317	35
Moving and placing	12	03	7	01	6	15	7	21	21	58	13	11	67	49
Miscellaneous	7	42	1	40	14	23	7	58	4	43	..	..	36	26
Holidays, etc	..	..	..	..	13	00	..	..	29	53	..	..	42	53
Total	131	23	131	49	152	20	122	29	206	48	55	46	800	35

ESTIMATE OF COST OF DREDGING.

The cost of operations for the season, commencing with May 5, 1899, and ending Oct. 16, 1899, is given below in detail.

During this period 316,343 cu. yds. of material, scow measure, was dredged. The place measure was 286,335 cu. yds., showing an increase of 30,008 cu. yds. by scow measurement, or 10.48%.

The monthly expense of operating the dredge is shown below:

1 Runner	$90.00
1 Second Runner	35.00
1 Fireman	35.00
1 Deckhand	35.00
1 Greaser	30.00
1 Watchman	30.00
7 Deckhands, at $30.00	210.00
1 Cook	30.00
1 Cook's Helper	15.00
	$510.00

For working overtime the men received 15 cts. per hour; the runner 30 cts. per hour. The supplies for board cost $12 per month per man.

As the superintendent had charge of both the dredging and gravel filling, one-half his wages, or $62.50 per month, is charged to dredging.

The cost of the fuel was 52½ cts. for every 100 cu. yds. of material excavated.

To keep the dredge and scows free from water, an old dredge was rigged up with a steam siphon, the cost of which per month was:

1 man, per month	$40.00
Coal, 20 tons, at $1.50	30.00
	$70.00

Other expenses were as follows:

New cables (steel)	$100	per month
Oil, dope, waste, etc	20	" "
Blacksmith shop	175	" "
Lines, cables, etc. (hemp)	40	" "
Miscellaneous expenses	50	" "
Yard expenses	100	" "

Range piles and buoys cost $256 for the season.

Small tugs, coaled	$20	per day
Large tugs, coaled	25	" "
Larger tugs, coaled	30	" "

The assumed value of the plant is as follows:

Clam-shell dredge, "Fin Mac Cool"	$60,000
Steel dump scow, "Protective Policy"	12,000
Steel dump scow, "Gold Standard"	10,000
Steel dump scow, "Cuba Libre"	10,000
Total	$92,000
Annual depreciation, 10%	9,200
Annual interest, 6%	5,520
Total	$14,720

Total expenses for the season of 1899:

Superintendence	$329.07
Wages	2,823.14
Board	980.34
Coal	1,690.80
Towing, tug hire	5,830.00
Syphoning	369.24
Cables, main, steel	527.49
Lines, ropes, etc., hemp	210.99
Blacksmith shop	923.11
Yard expenses	527.49
Miscellaneous expenses	263.74
Range piles and buoys	256.00
Total	$14,702.01
Depreciation and interest	14,720.00
Total	$29,422.01

Cubic yards excavated..... 316,343

Cost per cubic yard..... $29,422.01 / 316,343 = $0.09³⁰/₁₀₀

Operating expenses ..... $14,702.01 / 316,343 = $0.04⁶⁴/₁₀₀

Depreciation and interest..... $14,720.00 / 316,343 = $0.04⁶⁵/₁₀₀

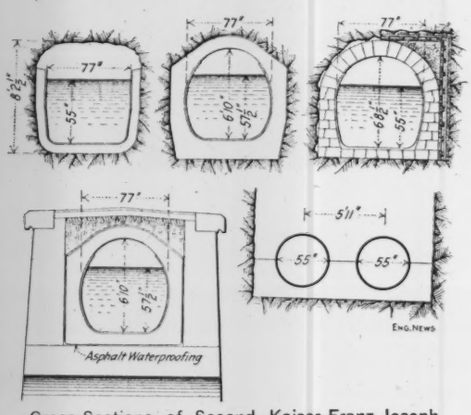
The price paid the contractor was 18 cts. per cu. yd., amounting to $56,941.74. Soon after the completion of this work this dredge was towed (in the fall of 1899) to Long Island Sound, via the Welland Canal and St. Lawrence River. After working here a short time, the dredge was transferred to the improvement of Bay Ridge and Red Hook Channels, New York Harbor, for which work Hughes Bros. & Bangs are the contractors.

AN ELECTRIC LIGHTING PLANT OPERATED BY wind power has recently been installed at Noblesville, Ind., and is reported to be giving entire satisfaction. It consists in part of a 14-ft. windmill on a 50-ft. tower. This drives a plunger pump which delivers water to a reservoir in which a constant pressure of 75 lbs. per sq. in. is maintained by weights mounted on a plunger in the reservoir. This water, under pressure, is used when necessary to drive a ½-HP. turbine wheel which is direct-connected to a ¼-HP., 25-volt dynamo, for charging the storage battery. The battery consists of eleven cells, and lights 20 8-c. p. lamps for 3 hrs. or 5 8-c. p. lamps for 6 hrs. Ordinarily, the windmill should run 5 hrs. per day to generate sufficient current for winter use, and 2 hrs. per day for summer use. Automatic hydraulic devices, however, enable the pump to store any amount of energy the windmill may produce. The Windmill Electric Co., of Noblesville, Ind., designed and installed this interesting equipment.

A NEW CONDUIT FOR THE WATER SUPPLY OF VIENNA, AUSTRIA.

The city of Vienna, Austria, is now building a new conduit for supplying water from distant mountain streams to the city distribution system. The conduit is no less than 114 miles long and draws water from six different sources, one of which requires pumpage to bring it to the level of the conduit. The total fall from the highest of the six sources to the delivery point in the city is 1,658 ft.

The first supply of mountain water was brought into the city in 1873, by way of an aqueduct 55 miles long, with a fall of 920 ft. Together with some extensions, this conduit, called the Kaiser-Franz-Joseph Aqueduct, now supplies 18,000,000 gals. per 24 hrs. per day in winter, or about 29,000,000 gals. in summer, as a minimum, and its total length is now 65 miles. Its capacity is somewhat greater than the available supply at the head waters, and amounts to 36,500,000 gals. per day. When the city of Vienna was enlarged by the annexation of suburbs in 1891, the long-existing need for a further water supply became imperative; with a population of about 1,500,000, only 24 gals. per capita was available. Extensive studies resulted in the acquisition, in 1899, of a large group of mountain springs and spring lakes, and the preparation of plans for a second aqueduct almost twice as long as the first, to conduct a new supply to the city. The second aqueduct is to have a carrying capacity of 53,000,000 gals. per day.



Cross-Sections of Second Kaiser-Franz-Joseph Aqueduct for the Water Supply of Vienna.

The new aqueduct, called the Second Kaiser-Franz-Joseph Aqueduct, is composed wholly of rock tunnels and iron pipe conduits. Unlike the first aqueduct, which was laid in a continuous series of descending gradients, holding as close to the hydraulic grade as possible, the new aqueduct follows much more nearly the surface of the ground, and involves a number of inverted siphons for valley crossings, the largest being nearly 6 miles in length (1,240 ft.). Much of the line is in tunnel in earth or rock, the total length of tunnel sections being 44 miles; the longest tunnel is 17,630 ft. between portals.

The cut herewith shows some of the cross-sections used on this conduit. Particular attention is called to the section given for valley crossings on the hydraulic grade. Masonry arch aqueduct construction, carrying a concrete conduit enclosed between masonry spandrel walls, is used here. Between the conduit and the masonry a layer of asphalt is placed, as water-seal in order to prevent leakage of water through the inevitable fine cracks, which leakage involves continuous damage to the masonry work.

The tunnel through the Göstling Mountain, the longest on the line of the conduit, was completed early in the current year. The first part of it was drilled by hand, but later machine drilling, using Siemens' electric crank percussion drills, was employed. Considerable difficulty with water retarded the progress of the work. The maximum advance with machine drilling was 19.7 ft. per day for each heading, and the maximum monthly advance with continuous working was 456 ft. per heading.

ORDINANCES RELATING TO THE INSTALLATION AND INSPECTION OF ELEVATORS AND THE USE OF ASBESTOS THEATER CURTAINS IN PHILADELPHIA.*

All passenger and freight elevators must be inspected at least once every three months to see that they are in perfect working order, and that all parts are in good condition and repair.

Automatic locking devices, electrical or mechanical, must be placed on all passenger elevators to hold the car immovable while any gate, door or doors at the car landings is or are open and unsecured. These devices must place the power of controlling the elevator beyond the control of the attendant during such times.

Lights of wire glass in metal frames may be placed in the enclosure walls and in the fireproof doors leading thereto, providing no one pane of wire glass exceeds in area 250 sq. ins. between muntins.

The roofs over enclosed elevators must be of fireproof materials, with skylights above the roof at least three-quarters of the area of the shaft, made of glass set in iron frames.

All hatch doors must be completely covered on the underside with asbestos and tin; both asbestos and tin must be folded over the edge of the doors and cable slots, and be lapped over the upper side not less than 1 in. The doors must be made in two parts, and open and close automatically whenever possible. If it be impossible to make them work automatically, they must be arranged to hook back with fusible fastenings and close automatically when the fuses melt.

FREIGHT ELEVATORS.

Counterweight boxes made of wood may be used on freight elevators when the speed is less than 75 ft. per min.; they must, however, be covered with asbestos and tin.

Non-metallic cable shall not be used for the suspension of hand or power operated freight elevators.

The safety device must be placed under the car platform where the speed of the car is to be 75 ft. per min., or more, or where the average load is to be over 2,000 lbs.

A loud ringing gong that will ring continuously while the car is descending, must be provided for freight elevators not guarded by a vertical enclosure.

The allowable loads for the various sizes of cables and sheaves or drums for freight elevators, are given in the following table:

Size of rope.	Minimum diameter of drum or sheave.	Maximum load on one rope.
in.	ins.	lbs.
½	20	1,500
9/16	22	1,800
5/8	25	2,250
¾	30	3,000
⅞	35	4,000
1	40	5,000

PASSENGER ELEVATORS.

The framework of every passenger elevator hereafter constructed and installed in any building shall be of iron and steel, and the car and counterweight shall operate on steel guide rails. No passenger elevator shall have a compartment below the main floor of the car. Maximum speed of passenger elevators shall not exceed 600 ft. per min. The car operator must not be less than 16 years of age.

An emergency safety device must be provided on all rope-hoisted passenger elevators, and be placed in a position accessible to the elevator conductor, by the use of which the car may be readily stopped in case of excessive or dangerous speed.

Inside sliding doors or gates shall be provided on every passenger elevator hereafter installed, and it shall be the duty of the operator to keep each inside gate or door closed while the car is in motion.

A trap door must be provided in the top of the car, of sufficient size to afford easy egress for the passengers.

Passenger elevators used for emergency loads, such as lifting safes, etc., must be provided with a device to support the car independently of the ropes or plunger while loading and unloading.

Power transmission by means of belts or chains must not be used.

The counterweights must be enclosed at least 2 ft. in excess of the length of weight from the bottom, and for the same distance at the top of the hatchway, with a substantial grille screen or solid enclosure to prevent the weights from falling over into the hatchway.

An effective air cushion or a device that will meet the approval of the Bureau in lieu of same, must be provided.

The allowable loads for various sizes of cables and sheaves or drums, are given in the following table:

Size of rope.	Minimum diameter of drum or sheave.	Maximum load on one rope.
in.	ins.	lbs.
½	20	1,100
9/16	22	1,350
5/8	25	1,700
¾	30	2,500
⅞	35	3,200
1	40	4,000

A factor of safety of not less than 5 must be allowed for all parts of passenger elevators, provided that all drum shafts, car frames and overhead supports of steel, shall have a factor of safety of not less than 6, and of wood a factor of not less than 10.

A sufficient run of cable must be used to allow the car to travel to the bottom of the air cushion.

Door interlocking devices must be used, but none shall be installed in which the actuating current is obtained from a primary battery. The device must prevent the landing door from being opened either from inside or outside, except when the car is within 3 ins. of its landing in the case of hydraulic elevators, or within 4 ins. of its landing in the case of electric elevators.

ASBESTOS THEATER CURTAINS.

The proscenium curtain shall be composed of asbestos of long, tough, flexible fiber, twisted and wrapped upon substantial brass wire thread, and woven into a close even cloth, 3 ft. wide. The strips must be lapped not less than 1 in. and sewed with two lines of asbestos and brass wire thread stitching. All strips shall be in one continuous length the full height of the curtain. There shall be at least four laps of the cloth at the top and at the bottom of the curtain to form pockets for the top and bottom bars, and the curtain shall be lapped on the sides to form a continuous reinforcement for the guide clips.

The curtain shall be at least 36 ins. wider than the proscenium masonry opening, and at least 2 ft. higher than the highest point of the proscenium arch. It shall have wrought iron or rolled steel top and bottom bars proportional in size to the width of the curtain, but not less than 1 in. × 2½ ins. The top and bottom bars shall be connected by four steel wire cables 3-16 in. in diameter to support the weight of the bottom bar.

The curtain must be supported by steel lifting cables, one at each end, and one at intermediate points not over 10 ft. apart. It shall be balanced by a counterweight only to such an extent that when it is tripped the descent will be made in 15 sec. The curtain must operate in guides, bolted every 2 ft. to the proscenium wall. All apparatus connected with the curtain or its operation shall be of metal. Any paint used on the curtain must be incombustible.

*Extracts from pamphlets issued by the Department of Public Safety, Philadelphia, Pa.

SMALL GAS PIPES laid in cinders in the Norwegian Hospital, Fourth Ave. and 46th St., Brooklyn, N. Y., were found a short time ago to be almost entirely destroyed. These pipes were ⅜ and ½-in. gas pipe laid about 1½ ins. deep in the cinder fill about the girders. The pipes had to all appearances been destroyed by electrolysis, but tests failed to show any stray electric currents. Moreover, as all pipes except those laid in the cinder were intact, the destruction was doubtless due to the composition of the ashes, possibly to sulphuric acid contained in them.

A EUROPEAN BRAKE ADJUSTER AND INDICATOR.

In the operation of the air-brake equipment on railway cars it is important that the piston should have a certain minimum and maximum travel in the cylinder, the first to prevent the escape of air from the cylinder, and the second to prevent too great a consumption of air. The inspection and adjustment of the brake rigging to maintain the piston travel within these limits is an important matter which is apt to be to some extent neglected in service, and a number of devices have been invented for making the necessary adjustment. In Europe, the Chaumont device has been used to a considerable extent, and it is proposed to introduce it in this country; this device also has an indicator (with

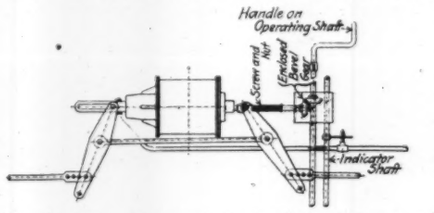


Fig. 1. The Chaumont Brake-Slack Adjuster for Operation by Hand.

pointer traveling over a dial) showing at any time the exact travel of the piston. The adjusting apparatus consists of a transverse shaft under the car, upon which is a bevel wheel gearing with another wheel on a screw shaft having a nut to which the brake lever is connected. The shaft can be turned by a portable crank handle, as shown in Fig. 1, or it can be made automatic, as shown in Fig. 2. In the latter case, a double ratchet wheel (or grooved wheel with both flanges notched) is keyed upon the operating shaft, and a double pawl attached to the piston rod engages with one of the teeth when the stroke exceeds the desired maximum. When the brake is released, and the piston is withdrawn within the cylinder, the pawl revolves the ratchet wheel and shaft, thus shifting the position of the attachment of the rods. By holding up the pawl, the automatic adjustment is disconnected and the adjustment can be made by hand in the usual way. This enables the accuracy of the automatic adjustment to be readily tested.

An enameled iron plate on the sill of the car is marked for "Adjustment," "Application" and "Release"; the screw is turned until the brakeshoes

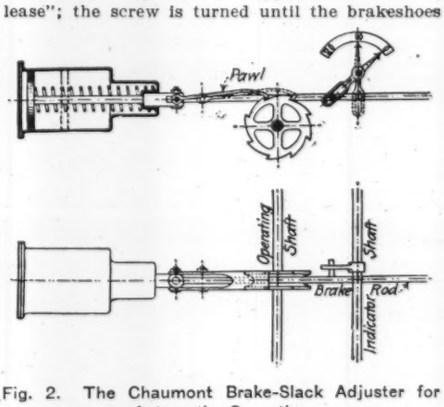


Fig. 2. The Chaumont Brake-Slack Adjuster for Automatic Operation.

are in contact with the wheels, and is then slacked back to a certain extent indicated by the pointer on the dial. The adjustment is generally made while the cars are in the yards, when the brakes are off, but the travel of the piston can at any time be increased if it has been set too short or if new brakeshoes have insufficient play.

The device above described is the invention of Mr. Chaumont, Inspector of the Belgian State Railways, at Brussels, Belgium, and has already been applied to about 3,500 cars of different railways in Europe, including the electric underground railway of Paris. It is also used on all the cars of the International Sleeping Car Co. and on the Brussels street railways.

THE DECOMPOSITION OF CEMENTS IN SEA WATER.*

By H. LeChatelier.†

If chemical reactions are the primary cause of the hardening of cement, it does not necessarily follow that all the reactions which take place among the products should have the same effect. On the contrary, there are cases where chemical reactions lead to the disintegration of cement. They may do this in two totally different ways fraught with very unequal degrees of danger. The reactions may simply bring about a softening of the mass through a formation of compounds having a gelatinous consistency, the cement then losing its hardness and succumbing easily to mechanical agencies which attack it from the exterior—more particularly the action of waves—although its general appearance remains unchanged; or they may be accompanied by swelling and cracking until the material is wholly destroyed. For instance, when lime is slaked (an essentially chemical phenomenon), its hydration causes a swelling and cracking of the entire mass; but the hydration of lime is not the only chemical operation capable of producing similar fissures and swelli for the action of sulphates upon hydraulic cements gives rise to the same phenomena of disintegration in a much less rapid fashion.

The decomposition of cement is an effect of two successive actions: 1. The removal of lime by diffusion, which destroys the solidity of the material, and increases its porosity. 2. The swelling and disintegration of the weakened mass caused by the attack of calcium sulphate. The first phase of the phenomenon necessarily occurs in two very distinct periods. As long as cement contains free lime, the relatively great solubility of the latter enables it to diffuse rapidly; but when the lime has disappeared, and only silicates and aluminates remain, decomposition is still able to proceed in the same fashion because these bodies dissociate on coming into contact with water. Nevertheless, as the amount of lime liberated by dissociation is extremely minute, its elimination by diffusion is equally slow.

The mechanism of the second phase (decomposition by swelling) is more difficult to understand, for there is no penetration of foreign salts into the cement. It would seem that the cavities and cracks found in an old cement result solely from the stresses set up in the superficial skin by the process of expansion. As long as this skin is not firmly attached to the cement it may be detached without prejudice to the internal resisting power of the material; but when once, through the partial removal of the lime, the film has begun to be precipitated within the pores of the cement, and thus adheres firmly, the strains resulting from the swelling which arises in course of time succeed in producing cracks in the cement itself.

If it be admitted—and the author's experiments appear to establish it as a fact—that all the phenomena of decomposition which occur when cements are exposed to sea water (elimination of lime as well as swelling) depend on the action of a little impervious skin, possessing a greater or less power of expansion, and only a few tenths of a millimetre in thickness at the most, we can at once see why the behaviour of cement on a large scale is apt to appear capricious. Its degree of permanence is governed by the conditions that control the formation and destruction of this skin, which is in a state of perpetual transformation like a living creature, for lime is constantly being brought by diffusion to act upon its inner surface, while the magnesian salts of sea water attack it persistently on the outside. The magnesium compounds destroy the calcium sulph-aluminate which is then formed again either at the same spot or deeper in the body of the cement according to the irregularities in circulation of the lime and of the said magnesium salts.

The most important conclusions from a chemical point of view, regarding the decomposition of hydraulic cements when exposed to sea water, are the following:

1. All the active ingredients in cements: lime, aluminates, and silicates, are decomposed immediately they come into direct contact with the magnesium salts of sea water, yielding soluble chlorides and sulphates of calcium, and so bringing all the lime present into a state of solution.

2. When the calcium sulphate found in natural waters or formed by the interaction of magnesium sulphate and the calcium compounds of cement reacts with calcium aluminate, it produces a calcium sulph-aluminate whose crystallization gives rise to swelling and cracking in the material. The action resembles that consequent upon the hydration of quicklime, but is much slower.

3. Penetration of marine salts takes place in two different ways; sea water penetrates en masse through all the flaws in the points of the masonry and through the crevices in the stones and bricks themselves. Most of these flaws in workmanship are unavoidable. From the present aspect, the normal porosity of cement plays only a secondary part in the process. Afterwards, when the cement is sound, circulation of, and attack by, sea water occurs almost exclusively by a process of diffusion, being the more rapid as the normal porosity of the cement is the greater.

4. All the phenomena of decomposition in sea water are at the mercy of a superficial film of extreme tenuity, whose impermeability tends to prevent, or rather to hinder, diffusive action, but whose expansion, caused by the formation of calcium sulph-aluminate, promotes swelling of the material and cracks through which the salt water soon penetrates in quantity.

*Extracts from a paper presented before the International Association for Testing Materials.
†Paris, France.

AN INTERESTING WATER POWER DECISION: UNION WATER POWER CO. VS. CITY OF LEWISTON, ME.

The interpretation of a water power contract, involving an unusual feature, has been made by the Supreme Court of Maine in a suit between the Union Water Power Co. and the City of Lewiston. The practical point at issue was whether or not the city had been drawing water for power purposes in excess of its contract right from the mill-pond at Lewiston Falls. The issue hung upon a contract made in 1887, under which the city paid $200,000 for a small piece of land for a pumping station, and also for a perpetual right to water for city purposes and water for power to pump the same. The grant of water for general purposes gave the city the right

to take so much water every 24 hours, for domestic, fire, mechanical, manufacturing and other purposes, as 600 HP., at a head of 25 ft., will pump from the Androscoggin River above the dam, near the Lincoln Mill, so-called, in said Lewiston, to a height of 220 ft. 12 hours in each 24; said city of Lewiston and its successors to have the right to pump said above stipulated quantity of water during any part of or all of the 24 hours.

The grant for power purposes empowered the city to take

water to the extent of 600 HP. for the purposes of pumping and distributing the water aforesaid from said river; provided, however, that for said 600 HP. the head shall not be less than 25 ft., nor exceed 30 ft.

The controversy was over the last-quoted portion of the contract. The claims of the company and the city have been outlined for this journal by Mr. Walter H. Sawyer, M. Am. Soc. C. E., agent of the Union Water Power Co., Lewiston, Me., as follows:

The Union Water Power Co. claimed that the strict interpretation of the lease would result in the city of Lewiston having the right to water which would amount to 600 theoretical horse-power, but admitted in evidence and in argument that it was customary to sell water for power purposes in the city of Lewiston on the basis of 75% efficiency. Two computations were submitted by the Union Water Power Co. in evidence: one based on the use of 600 H.P. of the water at 100% efficiency, resulting in a bill of $13,262. The other computation was made on the basis of 75% efficiency, which resulted in a bill of $3,469.

The city of Lewiston claimed the right to 600 HP. developed on the jack shafts. The wheels at the pumping station are capable of developing at least 75% efficiency when run at proper speeds and at from seven-eighths to full gate opening. The pumps, which were put in in 1878, have become badly worn, and are in poor repair, with the result that it is not deemed advisable to run them to anywhere near their full speed. As a consequence the speed of the wheels is also reduced together with the amount of wheel gate opening, speeds being about one-half the amount called for at installation and gate openings about one-quarter of full gate. The combined result of this reduced speed and low gate opening is an efficiency of from 35 to 40%.

The court found the city liable for all water used in excess of 600 HP. at 75% efficiency, which is exactly in accordance with the admission of the plaintiff.

After a lengthy review of the history of the contract and other various points involved in interpreting the above and other clauses, the court expressed its opinion that the clause in controversy was intended to define

the quantity of water and not the amount of power or mechanical force, and fixes that quantity of water to be that which will produce 600 practical horse-power reckoning the practical efficiency to be 75% of the theoretical, or, in other words, 800 theoretical horse-power.

In the course of its opinion the court pointed out that the quantity of water necessary to produce 600 HP. must, of course, vary "with changes in the character and condition of the conduits, flumes, gates and wheels and with changes in the degree of the skill and care of operation, all of which were to be, and are, under the exclusive control of the city."

The value of the excess water, based on evidence submitted, was placed at $12.50 per HP., to apply to excess water used during a period of six years. On this basis, a total of $3,469 was awarded to the company.

ADDITIONAL INFORMATION ON THE DURABILITY OF WOODEN STAVE PIPE.*

By Arthur L. Adams,† M. Am. Soc. C. E.

Ten years ago the writer made a special study of wooden stave pipe with reference to its suitability for conveying water under pressure, and the principles governing its economic design. The result of those studies he has previously laid before this society.‡ A description of the use of 7½ miles of this class of pipe at Astoria, Ore., has also appeared in the Transactions.

That this pipe at Astoria has proven deficient in durability, in defiance of all preconceived ideas as to what may be expected of wood when subject to constant water pressure and buried in the earth, is certainly somewhat startling, but nevertheless true, and the writer deems it a duty to the profession that the facts be made known. In order that what is stated herein may be readily followed, a profile of the pipe line in question is submitted, and for full information as to the extreme care with which this line was designed and built, reference is made to the writer's paper, entitled "The Astoria City Water-works."§

The staves of the pipe in question had deteriorated so much after ten years' use, that, during 1905, very extensive renewals and repairs became imperative, involving an expenditure of more than one-third of the original cost of the pipe. These repairs were made under the immediate direction of Mr. Lars Bergsvik, who served as an assistant engineer on the original construction of the Astoria water-works. The information herein contained has been derived from him, from personal interviews with several members of the water commission, who have served on the board continuously from the beginning, and from personal inspection of many of the staves removed during the process of repair.

The salient and important facts brought out by this experience are as follows:

(1) Staves, which are constantly subject to water pressure from within and are buried in the ground, may be very short-lived.

(2) The magnitude of the water pressure, beyond a moderate head, has had little or no influence in preserving the timber.

(3) The pipe laid above ground has not deteriorated to any considerable extent, nor has the pipe laid in the tunnels leading from the distributing reservoir.

(4) Where buried, its durability has depended upon the soil conditions and the depth of backfill.

(5) When the depth of backfill has exceeded 2 ft. above the pipe, and the material has been free from vegetable matter, and has been of a fine and impervious character, much less deterioration has taken place.

(6) Wherever the staves have been in contact with loamy earth or earth containing vegetable matter, or wherever they have been covered with porous material, or to a depth of less than 2 ft., rapid decay has resulted.

(7) Decayed staves have been found all around the pipe.

(8) Sound staves have been frequently found contiguous to badly decayed staves.

(9) The character of the grain, whether slash or grain edge, has not influenced the durability.

(10) The bruising of the staves during the process of erection seems to have been one of the chief agencies in hastening decay.

(11) Decay has been confined to the outside of the pipe.

(12) The pipe has not usually shown leakage as long as sound wood has remained in excess of ¼-in. in thickness.

(13) The malleable cast band fastenings have been found to be in good condition.

(14) The bands, 7/16-in. in size, have been considerably corroded save where secured by the nut, but all have been used again by placing the nut in its original position.

As to the future of the pipe, Mr. Bergsvik gives the following opinion:

TABLE I. REPAIRS AND REPLACEMENTS IN WOODEN STAVE PIPE LINE, ASTORIA, ORE.

	Section 1. Lin. ft.	Per cent of whole.	Section 2. Lin. ft.	Per cent of whole.	Section 3. Lin. ft.	Per cent of whole.	Section 4. Lin. ft.	Per cent of whole.
(1) Pipe requiring partial substitution of new staves	6,850	54	....	....	2,200	21	6,350	49
(2) Pipe requiring rebuilding	1,450	11	....	....	360	3½	600	5
(3) Pipe uncovered and found in fairly good condition	1,450	..	600	....	6,940	..	4,800	..
(4) Pipe not uncovered, but thought to be in fairly good condition	3,050	..	3,000	....	900	..	1,200	..
Total	12,800	..	3,600	....	10,400	..	12,950	..
New staves required, equivalent to feet of pipe	1,960	..	7	....	800	..	1,500	..

TABLE II. LOCATION AND LENGTH OF MOST IMPORTANT SECTIONS OF WOODEN STAVE PIPE NEEDING REPAIRS.

Station.	Length of pipe, ft.	Station.	Length of pipe, ft.	Station.	Length of pipe, ft.
No. 80	40	Nos. 157 and 158	128	No. 447	110
No. 95	47	Nos. 160 and 162	108	No. 496	20
No. 97	40	Nos. 164 and 165	54	No. 526	97
Nos. 103 and 104	153	No. 391	25	No. 548	30
Nos. 147 and 149	206	No. 393	40	Nos. 553 and 555	175
Nos. 150 and 152	140	No. 395	36	No. 560	93
Nos. 152 and 153	108	No. 396	45	No. 561	84
Nos. 154 and 155	122	No. 416	46	No. 566	43
No. 156	30	No. 425	34	No. 611	36
....	...	No. 427	24	No. 612	22

TABLE III. COST OF REPAIRS ON TWELVE MILES OF WOODEN STAVE CONDUIT.

Year.	Cost.	Year.	Cost.	Year.	Cost.	Year.	Cost.	Year.	Cost.
1895	$108.58	1897	$63.67	1899	$46.10	1901	$243.18	1903	$350.18
1896	15.90	1898	65.50	1900	71.59	1902	314.03	1904	896.10

The pipe in the Second and Third Sections, 2½ miles (see Fig.), is nearly all buried in fine-grained sand, and will last perhaps ten years more by giving it a general repairing, say five years hence; but the greater part of the First and Fourth Sections will have to be replaced, I think, in about four years.

Table I shows the extent of the repair and replacement work performed. In explanation, it may be said that, where actual reconstruction was unnecessary, the staves on the bottom of the pipe were not generally disturbed, it being thought better economy to renew them only as leakage rendered it necessary.

Staves having a depth of decay of less than ½-in. were not disturbed. When no repairs were required for a continuous length of 75 ft. or more, the pipe was included in the third section of Table I., as "in fairly good condition." Shorter lengths were included in the first section, as "requiring partial substitution of new staves."

At the stations noted in Table II. (indicated on the profile), were located the most important of the sections requiring rebuilding.

Table III., taken from the book record of the Astoria Water Commission, shows the total cost of repairs on the entire 12 miles of conduit, including both the stave and steel pipe. The cost of making good the damage resulting from two quite extensive landslides is included in these figures. Of the remainder, by far the greater part has been expended on the stave pipe.

The steel pipe is considered to be in fairly good condition. Perforations, however, have occurred in a few places, the total number for the years indicated being as follows: 1902, 7; 1903, 3; 1904, 9; 1905, 8. The total cost for repairs has been $297 for 27 perforations.

The writer hopes that the recounting of this experience with stave pipe may lead to the accumulation, through discussion by others, of much additional information on this important subject. He wishes, however, to caution any one against hastily attributing the lack of durability in the case of the Astoria pipe to the use of fir for staves instead of redwood, as he is prepared to cite an important redwood pipe line in Southern California, built at about the same time as the line under consideration, which has not shown much, if any, better results. Lack of full and exact data makes further reference to it inexpedient at the present time.

CONCRETE TIES, made according to the designs of Mr. A. C. Chenoweth, of Brooklyn, N. Y., have been laid to the number of a thousand on the tracks of the Philadelphia Rapid Transit railway. The installation is an experiment which will be closely watched with a view to more extensive use if the trial proves satisfactory.

THE PETROLEUMS OF NORTH AMERICA.*

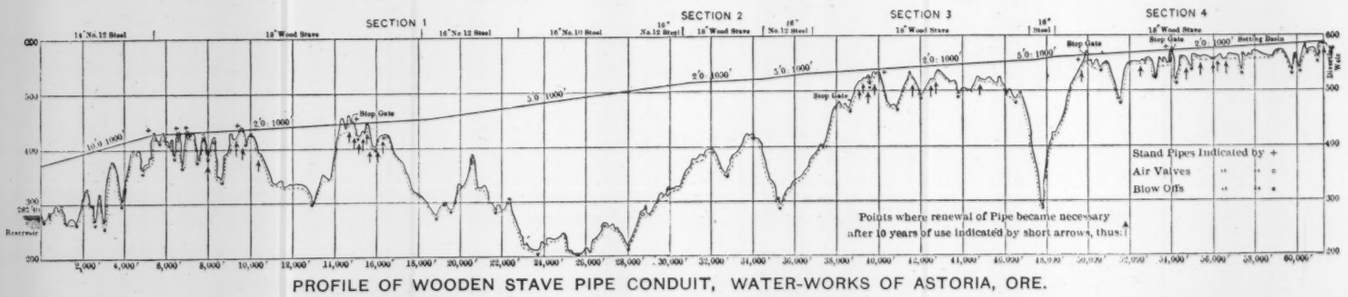
By Clifford Richardson †

The petroleums of North America are of a most varied and interesting character. Those of the earlier days of the industry, from the Appalachian field, were paraffine oils, and on this account and their freedom from sulphur have been the most valuable obtained in the United States or in any other part of the world, for the production of illuminants. Although the supply from this field forms a very much lower percentage in the total production of the United States than it has heretofore, and, although the production of the field has somewhat diminished, the value of the latter is greater than that of any other field and it will probably occupy this position for many years to come, since it is becoming extended from year to year and new pools are being developed, as is illustrated by the great increase in the production of West Virginia and Kentucky within the last few years.

The petroleum of Northwestern Ohio and Canada which next appear upon the scene chronologically, being sulphur oils, were far less valuable, not only on this account, but because of the smaller percentage of illuminants, until a process of distillation with copper oxide was discovered which made it possible to secure a satisfactory article. The Ohio field of late years has extended into Indiana and is of great importance not only as regards the value of its products, owing to the possibility of making paraffine illuminants from it, but also on account of the number of barrels produced. In 1904 it ranked third among the North American fields, with 21% of the total production.

Within the last ten years, the development of new fields has modified very largely the aspect of the petroleum industry in North America. California, which produced less than 5% of the entire supply of oil in 1899, in five years has more than quintupled that amount. This oil, however, is composed of such a series of hydrocarbons, of a non-paraffine nature, that its value is comparatively small, being nearly one-third less than that of the oil obtained from the Appalachian field. It does not offer a distillate which is satisfactory as an illuminant when burned by itself.

The oils from the more recently developed fields of Kansas and Texas are of variable character. Although all are more or less asphaltic, they also contain varying proportions of paraffine hydrocarbons, and the lighter oils are proving a vast source of supply of illuminants


SECTION 1
SECTION 2
SECTION 3
SECTION 4
Stand Pipes Indicated by +
Air Valves " " o
Blow Offs " " *
Points where renewal of Pipe became necessary after 10 years of use indicated by short arrows, thus:

PROFILE OF WOODEN STAVE PIPE CONDUIT, WATER-WORKS OF ASTORIA, ORE.

*A paper to be presented before the American Society of Civil Engineers, Oct. 17, 1906; reprinted from Proc. Am. Soc. C. E., September, 1906, pp. 580-85.

†Consulting Hydraulic Engineer, 36 Telegraph Ave., Oakland, Cal.

‡"Stave Pipe—Its Economic Design and the Economy of Its Use." By Arthur L. Adams. Transactions, Am. Soc. C. E., Vol. XLI., p. 27.

§Transactions, Am. Soc. C. E., Vol. XXXVI., p. 1.

*Extracts from a paper in the "Journal of the Franklin Institute."

†Director, N. Y. Testing Laboratory.

of a paraffine nature, which will, no doubt, continue to increase in importance in the future. The more asphaltic oils of the Gulf Coastal Plain of Texas and Louisiana are so strongly asphaltic as to be of value only for the production of lubricants, for use as fuel and as gas oil. They yield practically no paraffine illuminants.

It is also worthy of note that no petroleums have been found in North America of the Russian type, that is to say, consisting preponderatingly of monocyclic polymethylenes or napthenes.

The present aspect of the petroleum industry in the United States is a very satisfactory one. With the diminution of the output of paraffine oils in the Appalachian field, there has been an increase in that from the Indiana field, which makes the combined output from the two somewhat larger in 1904 than for that of five years ago, while the strongly paraffine petroleums of the new Kansas and some individual Texas fields have also added to the source of supply of desirable illuminants to such an extent as to be a matter of great importance, and to make the outlook for a continued supply of burning oil at the present time encouraging. The petroleum industry, however, is so kaleidoscopic that it is impossible to say whether there will be as great a change in the aspect in the next five years as there has been in the past.

THE PRODUCTION OF COAL IN THE UNITED STATES IN 1904 AND IN 1905.

The production of coal in the United States in 1905, according to a report by Edward W. Parker, Statistician of the U. S. Geological Survey, now in press, exceeded both in quantity and value all previous records for this country. The details by states for both the years 1904 and 1905 are given in a table reprinted herewith. It will be seen that the total production for 1905 was 392,919,341 short tons, valued at $476,756,963. It will be noted that about half the total quantity produced in 1905 was mined in Pennsylvania alone. A portion of the Pennsylvania increases in both anthracite and bituminous coal is attributed to efforts to forestall complications due to the expected suspension of mining in April, 1906.

Until 1899, Great Britain was the greatest coal producer of the world, but in 1905 the coal production of the United States exceeded that of Great Britain by 50%.

Regarding the use of mining machines and the number of men and boys employed, an abstract of Mr. Parker's report may be quoted as follows:

Of the total amount of bituminous coal produced in 1905 103,396,452 short tons were mined by the use of mining machines, as compared with a machine-mined product in 1904 of 78,606,997 short tons. The number of mining machines in use increased from 7,663 in 1904 to 9,184 in 1905.

The total number of men and boys employed last year in the coal mines of the United States was 626,174, against 593,633 in 1904. Of the total number employed in 1905, 165,406 were in the anthracite mines of Pennsylvania, and 460,768 were employed in the bituminous coal mines. The average number of days worked by the anthracite miners was 215, while the bituminous miners made an average of 211 days.

The increased coal production in 1905 is attributed for the most part to great activity in the iron industry, as is indicated by the fact that the amount of coal made into coke increased from 31,278,537 short tons in 1904 to 42,412,328 short tons in 1905.

Production of Coal in the United States in 1904 and 1905.

State or Territory.	1904 Short tons, millions.	1904 Value, millions.	1905 Short tons, millions.	1905 Value, millions.
Alabama	11.262	13.480	11.866	14.398
Arkansas	2.019	3.103	1.935	2.881
California and Alaska	.080	.377	.081	.396
Colorado	6.658	8.752	8.827	10.811
Georgia & N. Carolina	.390	.477	.354	.[illegible]
Idaho*	.003	.014	.006	.018
Illinois	36.475	39.942	38.434	40.578
Indiana	10.842†	12.004†	11.895	12.492
Indian Ter.	3.047	5.532	2.924	5.145
Iowa	6.520	10.504	6.799	10.586
Kansas	6.333	9.641	6.424	9.351
Kentucky	7.576†	7.868†	8.433	8.385
Maryland	4.814	5.729	5.109	5.832
Michigan	1.343	2.425	1.473	2.513
Missouri	4.168	6.802†	3.983	6.292
Montana	1,359	2,195	1,644	2,623
New Mexico	1,452	1,904	1,650	2,190
North Dakota	.272†	.380†	.318	.425
Ohio	24.400†	26.580†	25.553	26.487
Oregon	.112	.244	.110	.282
Pennsylvania:				
Anthracite	73.157	138.974	77.660	141.879
Bituminous	97.938†	94.428†	118.414	113.390
Tennessee	4.782	5.642	5.963	6.798
Texas	1.196	1.984	1.201	1.969
Utah	1.493	1.943	1.332	1.795
Virginia	3.411†	2.922†	4.275	3.777
Washington	3.138	5.121	2.865	5.141
West Virginia	32,407†	28,647†	37,792	32,342
Wyoming	5.179	6.748	5.602	7.337
Total	351.816†	444.371†	392.920	476.757

*Includes production of Nevada.

†Corrected figures. In the report for 1904, the total production for the United States for that year was given at 352,310,427 short tons, valued at $444,816,288. In collecting the statistics for 1905 it was found that in several cases where properties had changed hands or the name of the company had been changed the preceding year, the production for the entire year had been reported by both owners. The duplications thus made have been corrected for this report.

UNIFORM SYMBOLS FOR WIRING PLANS.

A set of symbols and suggestions for making wiring plans were prepared and adopted by the National Electrical Contractors' Association of the United States at its last annual convention. They are the work of a committee appointed at the fifth annual convention of the Association, held at Boston in July, 1905. This committee addressed letters to the leading engineers, architects, universities, the technical press and various departments of the government asking their opinion as to the advisability of establishing a uniform set of symbols, the most feasible methods of getting such symbols universally used, and the most desirable symbols. The replies to these letters were carefully studied and the suggestions, which seemed best adapted to make a complete, comprehensive and serviceable system were combined into the accompanying table. In developing this table those symbols already generally in use were adopted as far as possible. The Association is prepared to furnish marking stamps of these symbols, at cost, to those who desire them.

STANDARD SYMBOLS FOR WIRING PLANS AS ADOPTED AND RECOMMENDED BY THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES.

- Ceiling Outlet; Electric only. Numeral in center indicates number of Standard 16-c. p. Incandescent Lamps.
- Ceiling Oulet; Combination. 4/2 indicates 4 16-c. p. Standard Incandescent Lamps and 2 Gas Burners.
- Bracket Outlet; Electric only. Numeral in center indicates number of Standard 16-c. p. Incandescent Lamps.
- Bracket Outlet; Combination. 4/2 indicates 4 16-c. p. Standard Incandescent Lamps and 2 Gas Burners.
- Wall or Baseboard Receptacle Outlet. Numeral in center indicates number of Standard 16-c. p. Incandescent Lamps.
- Floor Outlet. Numeral in center indicates number of Standard 16-c. p. Incandescent Lamps.
- Outlet for Outdoor Standard or Pedestal; Electric only. Numeral indicates number of Standard 16-c. p. Incandescent Lamps.
- Outlet for Outdoor Standard or Pedestal; Combination. 6/6 indicates 6 16-c. p. Standard Incandescent Lamps; 6 Gas Burners.
- Drop Cord Outlet.
- One Light Outlet, for Lamp Receptacle.
- Arc Lamp Outlet.
- Special Outlet, for Lighting, Heating and Power Current, as described in Specifications.
- Ceiling Fan Outlet.
- S — S. P. Switch Outlet.
- S^2 — D. P. Switch Outlet.
- S^3 — 3-Way Switch Outlet.
- S^4 — 4-Way Switch Outlet.
- S^D — Automatic Door Switch Outlet.
- S^E — Electrolier Switch Outlet.

Show as many Symbols as there are Switches. Or in case of a very large group of Switches, indicate number of Switches by a Roman numeral, thus: S^1 XII.; meaning 12 Single Pole Switches. Describe Type of Switch in Specifications, that is, Flush or Surface Push Button or Snap.

- Meter Outlet.
- Distribution Panel.
- Junction or Pull Box.
- Motor Outlet; Numeral in center indicates Horse-Power.
- Motor Control Outlet.
- Transformer.
- Main or Feeder run concealed under Floor.
- Main or Feeder run concealed under Floor above.
- Main or Feeder run exposed.
- Branch Circuit run concealed under Floor.
- Branch Circuit run concealed under Floor above.
- Branch Circuit run exposed.
- Pole Line.
- Riser.

- Telephone Outlet: Private Service.
- Telephone Outlet; Public Service.
- Bell Outlet.
- Buzzer Outlet.
- Push-Button Outlet; Numeral indicates number of Pushes.
- Annunciator; Numeral indicates number of Points.
- Speaking Tube.
- Watchman Clock Outlet.
- Watchman Station Outlet.
- Master Time Clock Outlet.
- Secondary Time Clock Outlet.
- Door Opener.
- Special Outlet; for Signal System, as per Specifications.
- Battery Outlet.

- Circuit for Clock, Telephone, Bell or other Service, run under Floor, concealed. Kind of Service wanted ascertained by Symbol to which line connects.
- Circuit for Clock, Telephone, Bell or other Service, run under Floor above concealed. Kind of Service wanted ascertained by Symbol to which line connects.

Note.—If other than Standard 16-c. p. incandescent lamps are desired, specifications should describe capacity of lamp to be used.

SUGGESTIONS IN CONNECTION WITH STANDARD SYMBOLS FOR WIRING PLANS.

Indicate on plan, or describe in specifications, the height of all outlets located on side walls.

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans, it is desirable that they be designated by letters or numbers.

TUPELO, a timber which in its best grade closely resembles yellow poplar, is now being extensively cut for timber in the South and promises to become of great value in view of the growing scarcity of suitable wood for lumber. From a paper on the subject by H. B. Holroyd (Forest Service Circular No. 40, U. S. Department of Agriculture, Washington, D. C.), it appears that the wood is useful for a considerable variety of purposes, but "is not durable in contact with the ground, and requires much care in seasoning." Besides being largely used for packing boxes, Mr. Holroyd states that it has almost "replaced cypress and pine for use in tramways," and that the tupelo does not "sliver up and wear out in a few years from the heavy traffic of the lumber trucks and roughshod mules," as does pine. He also states that in view of the large amount of sapwood in tupelo it will probably take preservatives well, in which event "it may find a use for cross-ties, street paving and cross-arms." The tree is found from southern Virginia to northern Florida and westward to Texas, Arkansas and Missouri, and is frequently associated with cypress. At present tupelo is being made into lumber only in the vicinity of Mobile, Ala., and in southern and central Louisiana, where it occurs in largest merchantable quantity. On a freight rate basis of 23 cts. per 100 lbs. the quotations on rough tupelo (bay poplar) for July 1, 1906, as given in the New Orleans "Lumber Trade Journal," range from $10 to $18, according to quality.

MINERAL PAINTS were produced in the United States in 1905 to the value of $6,245,173, being a material increase over similar figures for 1904. For this purpose 125,202 short tons of ores and other materials were ground. These paints or natural pigments include mortar color, ocher, umber, sienna, zinc white, slate and carbonaceous shales and schists.

THE TOWING RESISTANCE OF A FLOATING DOCK.*

By Henry Aylwin Bevan Cole, M. Inst. C. E.

The author of this paper became interested some time ago in the towing of a large floating dock, and thought that an attempt might be made to deduce approximately the towing resistance of the dock from the I. HP. of the towing steamer, thus avoiding the expense and complication of a dynamometer. His investigations are based on two assumptions not strictly accurate but probably fairly correct within the limits of ordinary working.

The dock is 320 ft. long by 86 ft. wide, and the draft at the time of the experiment was 4 ft. 6 ins. The wetted surface at this draft is 31,655 sq. ft. The dock consists of three rectangular box-like pontoons, the center pontoon being 320 ft. long by 65 ft. wide, and the two side pontoons 272 ft. long by 8 ft. 6 ins. wide. The draft of the side pontoons is 2 ft., being 2 ft. 6 ins. less than that of the center pontoon. Each of the two side pontoons is separated from the center pontoon by a passage 2 ft. wide and open to the sea. The flow of water through these narrow lanes is considerably baffled by the brackets connecting the three pontoons together, and no doubt this obstruction to the free passage of the water along these two lanes accounts for a large portion of the resistance to towing. The dock was towed by a cargo steamer of about 9,500 tons displacement and 2,500 I. HP., having a maximum speed of about 11¼ knots per hr. In the following investigation this steamer will be called the tug.

The investigation is based upon two assumptions, viz.: (1) that the I. HP. of the tug is 2.25 times her Eff. HP.; or, in other words, that the tug's own propulsive coefficient is $\frac{1}{2.25} = 0.44$; and (2) that the augment of the tug's own resistance due to her propeller is 40% of her total resistance.

The power and speed curve for a sister ship to the tug having been previously obtained, the pull on the tow rope, i. e., the resistance of the pontoon, is arrived at by the following reasoning from the foregoing assumptions. The I. HP. of the tug is 2.25 times her Eff. HP., but the I. HP. of the pontoon, having no augment due to a propeller, will be about 2.25 — 0.4 = 1.85 times the Eff. HP. For example, when towing at 5½ knots per hr. the observed I. HP. was 1,094, the I. HP. of the tug for this speed, previously ascertained, being 240. The I. HP. due to the tow is the difference between these two powers, or 854. The Eff. HP. of the pontoon is $\frac{854}{1.85} = 462$, and the pull on the tow rope for a speed of 5½ knots per hr. is $\frac{462 \times 33{,}000}{5.5 \times 100 \times 2{,}240} = 12.37$ tons. The power required to drag the tow rope through the water is considered negligible. The powers were taken for three speeds, viz., 5½, 6¾ and 7½ knots per hr., the speeds being measured by a speed indicator, which had been ascertained to be correct within about 5%. It is obviously very inconvenient to try such an unwieldly vessel on a measured mile. The weather during the trials was moderate. The results obtained are given in the accompanying table:

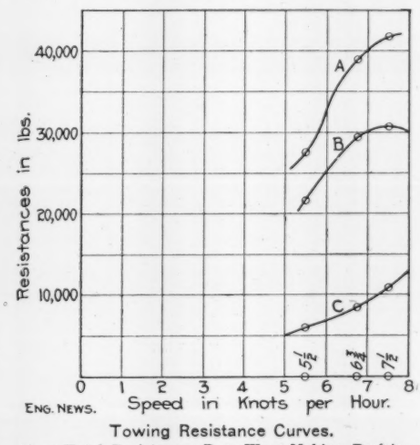
Speed in knots per hour.	Observed I. HP.	I. HP. of tug previously determined.	I. HP. of tow by difference.	Eff. HP. of tow = I. HP. / 1.85	Resistance of tow or pull on tow-rope, tons.	Resistance of tow in lbs. per sq. ft. of wetted surface.	Calculated skin resistance of tow, lbs.	Wave-making resistance of tow, lbs.
5½	1,094	240	854	462	12.37	0.875	5,838	21,870
6¾	1,857	400	1,457	790	17.24	1.219	8,794	29,823
7½	2,300	570	1,730	935	18.36	1.299	10,857	30,269

It is thought to be of some interest to analyze the total resistance of a body of such unfavorable shape, in order to ascertain in what manner the skin resistance and wave-making resistance, taken separately, vary with the speed. The skin resistance is assumed to be 1 lb. per sq. ft. of clean wetted surface at a speed of 12.8 knots per hr., and that it varies as the 1.8th power of the speed (here taken as the square for simplicity). The wave-making resistance is then arrived at by subtracting the calculated skin resistance from the total resistance. These resistances have been plotted in the form of curves in the accompanying figure.

A floating dock is, of course, not built with a view to economical propulsion, and it is not surprising that even at these low speeds the wave-making resistance far exceeds the calculated skin resistance. It is interesting to observe the very low speed, namely, about 6¼ knots per hr., at which the rate of increase of the total resistance begins to fall, as compared with that of properly formed ships. The average speed over the whole voyage of 6,000 miles was about 5 knots per hr.

*From the "Proceedings" of the Institution of Civil Engineers.

In estimating the power required of the tug it will be sufficiently accurate to take the towing resistance, i. e., the pull on the tow rope, for similar docks, as 1 lb. per sq. ft. of wetted surface, at a speed of 6 knots per hr., which is quite fast enough for a structure not built for progression. The Eff. HP. of the tow is obtained by multiplying the resistance of the tow at 6 knots per hr. by 600 ft. per min., and dividing by 33,000. This multiplied by 1.85 gives the I. HP. of the tow, and to this product must be added the tug's own I. HP. for a speed



Towing Resistance Curves.

(A = Total Resistance; B = Wave-Making Resistance; C = Calculated Skin Resistance.)

of 6 knots per hr. Needless to say, a good margin must be allowed for head-winds, etc. For the case described,

$$\text{the Eff. HP. of the tow} = \frac{31{,}655 \times 600}{33{,}000} = 575,$$

and the I. HP. of the tow = 575 × 1.85 = 1,063.

It will be seen that the formula is very easily applied, and although no doubt not strictly accurate, it may serve as some guide to the work which a tug will be required to do when towing structures similar to that experimented upon.

CONCERNING A METHOD OF AUTOMATIC LUBRICATION FOR SMALL HIGH-SPEED ENGINES.*

Fully 80% of the troubles in small engines are due to improper lubrication; whereas only about 10% are due to inadequate proportions and finish of the working parts, and the other 10% to the neglect or ignorance of the operator.

It will thus be seen that the efforts of most engine designers have been in the wrong direction, and that greater attention should be paid to proper lubrication and refining some of the details than to the production of something entirely new.

Being so thoroughly impressed with the importance of a good system of lubrication, the first step was to work out something more effective than previously used.

It does not take much thought to arrive at the conclusion, that if metal does not run on metal, but is always separated by a heavy film of oil, there can be very little wear. The problem then settles down to the production of the necessary heavy film.

In looking over the many systems for lubricating engines, the most rational seemed to be forced lubrication by means of a pump. But experience shows this has many defects. The oil being under pressure necessitates extreme care in adjustment, as any bearing being looser than another vents the entire system and destroys the desired effect. Again, any foreign material that may get into the small tubes or grooves, which are an essential part of this system, will be rammed in tight by the oil pressure.

To overcome these objections it was decided to adopt a gravity flow, the oil being lifted by a pump to the top of the frame, from which elevation it would flow downward by gravity. In this way large tubes can be used; the velocity of the oil will be rapid, the volume of oil in circulation will be much greater; it will not be necessary to have the bearings tight, neither will they all have to be adjusted alike, and any foreign matter will be washed out, instead of being rammed in.

Being satisfied that this came close to the ideal way of producing the flow of oil, the next step was to distribute the oil along the bearing and wearing surfaces to completely separate them by that all-essential film.

For ages it has been common to groove the upper or lower half of the journal box or perhaps both. There are as many ideas on the proper way to groove a box as there are people in the business, and there are evidently many more who have no ideas at all, judging from the way it is sometimes done.

Considering the question from a mechanical standpoint, it is at once apparent that an oil film takes up space, so a bearing cannot be tight or the oil cannot get in unless it is forced in at a pressure greater than is exerted on the journal.

The thicker the film, the more space there must be between the metals, hence a loose bearing is desirable if it does not cause pounding. When the crank is on the downward stroke, it pushes the journal away from the upper part of the bearing. The shaft is also rolling in the direction the crank is traveling. Hence, the oil should enter at the beginning of the gap which intervenes between the shaft and bearing and thence be rolled up into the remaining space by the rotation of the shaft. The gap naturally begins at one side of the circumference of the shaft, so the oil grooves should most naturally be on the sides.

After the crank passes the lower center on the upstroke, oil should flow in from the groove on the opposite side in the same way. These grooves can thus be made large, say from ¼ in. to ⅜ in. in width and the whole length of the bearing metal.

The same scheme is applicable to the oiling of the main bearings, crank pin, crosshead pin, eccentric and governor weight pin, and it works to perfection, better even than was ever thought possible.

At Davenport, Ia., a 14 by 7 in. low pressure engine is running in a school building. The speed is 180 rev. per min., the steam pressure 40 lbs. At the start 4.5 gals. of oil was poured into the base, and in two years only one gallon has been added and one adjustment made, which was to the crosshead pin.

In New Orleans an induced draft fan was installed on an ocean tug, which is driven by a 5 by 5 direct connected engine. The steam pressure is 110 lbs. The engine runs about 360 rev. per min. The outfit was installed in February, 1904, and up to November 29, 1905, about twenty-two months, only three gallons of oil had been put into the engine and one adjustment made to the crank pin. This engine runs continuously, 24 hrs. per day for three or four days at a time. It is seldom that it ever stops entirely, as it is turning over slowly even when the tug is tied to a dock. It is located in a very hot place over the boiler and withal is operated under about the worst possible conditions.

After the oil has performed its usual functions it must be filtered, cooled and the water separated from it. Any of the usual methods of filtration were found unreliable, as they all allow pieces of lint or grit to pass through. After much experimenting it was found that a plain closely-woven cloth suspended by four hooks from each corner of the frame, hanging just below the crank and above the oil in the base, gave the best results. All the oil dripping down from above lodges on this cloth and passes through to the reservoir below. Any foreign matter is left on top and has no tendency to leave the upper surface. Simple as it is, it has been surprisingly effective. As an extra safeguard a fine copper wire screen of ample area was attached to the pump suction and another to the discharge, both being easily removable for cleaning.

The pump first adopted was of the plunger type, actuated by an eccentric on the shaft. It was thought too complicated, however, and was abandoned for a gear pump. On the shaft is a large bronze worm with coarse teeth into which meshes a small spur gear attached to a shaft supported at an angle of about 45°. The pump gears are within a case attached to the outside of the frame close to the bottom of the base, where they can be gotten at at any time. The discharge pipe from the pump is 0.75 in. diameter, and extends up inside of the frame to the top, where it discharges through a sight feed glass, so the engineer can easily see if the oil is flowing properly.

The oil then empties through a wire screen into a small tray, through the bottom of which latter project the various oil tubes nearly to the top of same. Each tube has a fine slit cut down the side of it to the bottom of the tray, so as to equalize the flow of oil into them all.

In adjusting the engine for this system no bearing should be so tight as to make it impossible to easily slide the connecting rod or shaft along parallel with its axis.

*Extract from a paper by Mr. F. R. Still, read before the Detroit Engineering Society, and published in the "Journal of the Association of Engineering Societies."

SAND AND GRAVEL to the amount of 23,174,967 short tons were produced in the United States in 1905, according to the U. S. Geological Survey. This is exclusive of such material taken from small beds owned by individuals for their own use, and therefore never reported. Of the above amount 1,030,334 tons were glass sand, 3,084,008 tons molding sand, 10,127,750 tons building sand, 205,473 tons fire sand, 477,771 tons engine sand, 346,743 tons furnace sand, other sand, 3,479,942 tons, and gravel, 4,422,856 tons. The total valuation of these products was $11,199,645.

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The terrible railroad accident which occurred at Grantham, England, on Sept. 19, as noted in another column, adds another to the exceptionally long list of serious accidents on English railways within the past twelve months, and gives emphasis to our recent remarks in regard to English railways and railway accidents. In some respects this latest accident resembled the one at Salisbury, which was discussed in our issue of Aug. 9. In both cases some forgetfulness or aberration of mind on the part of the engineman led to the running of the train at high speed past a point where it should have stopped (at Grantham) or slowed down (at Salisbury), with the result of derailing the train on a sharp curve. In both cases the engineman and fireman were killed, so that the actual causes must remain a mystery; at Grantham 12 persons were killed, which is a very high figure in English railway accidents (23 were killed at Salisbury); and about 12 more were seriously injured. The burning of the wreck was also an unusual feature, and it appears that several persons imprisoned in the wrecked cars were burned alive. The responsibility seems to lie entirely with the engineman. It has been suggested that if the switches had been set for the main track (which is straight) the derailment would not have happened, but as the train was to stop at the station and a train for the branch should have started first, there was every reason why the switches should have been set for the branch. Two points may perhaps be commented upon; the first of these is the inherent inferiority of the vacuum brake to the air-pressure brake, and many English railways are now using the latter; whether all the wheels of the train were braked does not appear. The second point is in regard to the curve alinement; in spite of the high speed the engine passed around it in safety and only left the rails just at the point of tangent. Whether any imperfection in the alinement at this point caused a critical lurch or shock, or whether a transition curve would have enabled the engine to pass in safety can be only matters of conjecture, but will be worth consideration in the expert inquiry which will be conducted by the Government authorities.

Another bridge of the "Aerial Ferry" type has recently been completed and opened to traffic in England, and some account of it is given on another page of this issue. As our readers will recall, one bridge of this general type is now in operation at Duluth; but has rigid suspension for the car in place of the flexible cable suspension which has been used on all the foreign installations. Recently it has been suggested that a "transporter" might be used for the transfer of vehicles and passengers across the Mississippi River at St. Louis, in connection with the proposed new long span bridge projected for construction by the city.

A serious defect of this type of bridge is its very small traffic capacity and the impossibility of increasing this in any way. This fact would seem to preclude its serious consideration for the St. Louis location, or, in fact, for any place in the vicinity of a large city where considerable growth of traffic is to be expected. If we take the bridge just opened at Newport, England, as an example, the car travels a distance of 592 ft. at a maximum speed of 10 ft. per second. Allowing for the time of acceleration and slowing down, the time from start to stop cannot be less than two minutes, and in rush hours it can hardly take less than two minutes at each terminal to discharge teams and passengers and take on a new load. This would make eight minutes as the minimum time for the round trip when carrying full loads, or only 7½ trips per hour in each direction. The car is only 33 ft. long by 40 ft. in width, and can accommodate therefore, we should judge, not over four vehicles at one time and perhaps 400 passengers. This means total maximum traffic capacity per hour in one direction of thirty vehicles and 3,000 passengers. If the length of span is longer, as at St. Louis, the number of trips per hour is correspondingly reduced. While a larger car might be used, the concentrated load which the car imposes on the overhead supporting structure, and the increased time required for loading and unloading with large cars, set a limit to this method of increasing the traffic capacity.

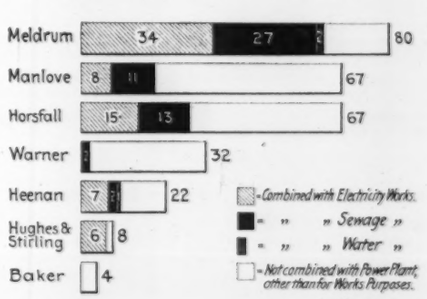
It must be concluded, therefore, that the "Aerial Ferry" is more notable as an engineering curiosity than as a valuable new means of over-water transit. In nearly every case, other methods of effecting the crossing will be found more satisfactory.

The durability of wood-stave conduits under constant water pressure has been accepted without question for so long that engineers will be surprised and perplexed to learn that such a conduit has shown much decay and required extensive repairs after being in use only ten years. The pipe in question is located at Astoria, Ore. An account of its recent condition and repairs, by Mr. A. L. Adams, M. Am. Soc. C. E., has been prepared for presentation to the American Society of Civil Engineers on Oct. 17, 1906, and is reprinted elsewhere in this issue.

It is of the utmost importance that this paper elicit a full and free discussion, which shall include statements regarding the life or decay of wood stave pipe elsewhere; for if the experience at Astoria is not exceptional, engineers may be forced to turn to other material than wood staves for water conduits. Mr. Adams' conclusions regarding the failure of the Astoria conduit indicate, in the main, that (1) decay was due to the alternate wetting and drying of the exterior of the staves and to fungus growths favored by these conditions and by organic matter in the soil; and (2) that the internal pressure of the water in the conduit was insufficient to keep the outer part of the staves wet. The question naturally arises, were not these and other conditions that cause decay in the Astoria conduit purely local? Every one having experience with or knowledge of the behavior of wood-stave conduits elsewhere will perform a service by citing such information as is available regarding their life history.

Should it prove that a substitute for wood-stave conduits is necessary, what shall it be? One of the great advantages of such conduits has been their cheapness, as compared with iron or steel, particularly where freight rates are high and where pipe lines are located in rough mountainous country. Where wood-stave conduits would be advantageous for the reasons indicated, but doubts exist as to their desirability, it may be necessary to treat the staves with a preservative or else to choose between riveted steel and reinforced-concrete conduits; unless, indeed, it be found that it is feasible to preserve the wood-stave pipe by keeping it above ground or by burying it deeply enough to protect its exterior from the effects of organic matter in the soil and of fluctuations in ground water. We shall welcome discussion in our columns of the various points involved, and trust that there will be a fruitful discussion before the American Society of Civil Engineers.

The extent both of refuse destructors and the utilization of heat from refuse in Great Britain is strikingly shown in the accompanying diagram, which has been redrawn from a recent article by Mr. W. Francis Goodrich, Assoc. Inst. M. E. (London). As may be computed from the diagram, out of the total of 280 destructors of various makes, 70 are combined with electricity works, 55 are used to pump sewage, 3 to pump water, and the remainder, or 152, supply no power "other than for works purposes." In the original article the diagram is entitled "Thirty Years' Progress with British Destructors."



Relative Numbers of British Refuse Destructors of Various Makes Combined with Electric, Water and Sewage Works.
(Redrawn from the Municipal Journal and Engineer.)

In this country refuse destructors, or more properly garbage furnaces, have been in use for some twenty years, or two-thirds the period covered by British experience; and yet it is only quite recently that any serious, or if serious any successful, attempt has been made to utilize the heat from the combustion of American municipal refuse. Aside from one Canadian plant, there is not to-day on the North American continent, so far as we know, a single furnace burning garbage, or garbage and other municipal refuse combined, that is even utilizing the heat for "works purposes." At a slowly increasing number of refuse sorting plants (at which paper, rags, twine, etc., are recovered for sale), the tailings are delivered to furnaces and supply heat to produce steam for driving belt conveyors and the like. The builders of these several plants have maintained from the start that there was a surplus heat which could be turned to account in other ways, but until the recent installation of the electric plant for lighting the Williamsburgh Bridge in New York City this assertion was not proved by practical experience. The reported success of the Williamsburgh Bridge plant and of the combined garbage and refuse destructor at Westmount, Canada, together with recent investigations of a somewhat broad character made for Columbus, O., and more recently for the Borough of Richmond, New York City, give reason to expect that in the near future American engineers and municipalities will be following, though long afterwards, their British cousins. Whether or not some years of practical experience in this country will prove that American garbage and refuse have as much heat value as British, and that such heat value as is produced can be commercially used in view of our greatly differing municipal and industrial conditions, is an interesting subject for specula-

tion. This journal has long maintained that there was a material difference in the composition of British and American municipal refuse, and is still of that opinion; but nevertheless it would be very glad indeed to see the questions involved settled by actual tests on a practical scale. Doubtless such tests might have been made years before this, had it not been for the footing gained by the various garbage reduction or utilization processes. Although we have little sympathy with much that has been written regarding the alleged sanitary faults of reduction systems, we are free to state, as we have done before, that our municipalities and the public generally know very little regarding the economic efficiency of reduction systems, owing to the fact that practically all of the reduction plants have been built and are operated by private companies which for obvious reasons keep their financial operations to themselves. These companies in many instances have been so closely allied with the political powers of the city, or even the state, in which they are located, that they have frequently been able to get pretty nearly their own prices for services rendered, thus leaving the public quite in the dark as to the real cost of garbage reduction. As soon as some of our large cities build adequate garbage furnaces or refuse destructors after the British plan, there may be a competition with the reduction processes brought about which will improve both means of garbage disposal and the cost of the service to the public.

The transcontinental excursion of the Canadian Society of Civil Engineers, an account of which is given on another page of this issue, was a notable event in the annals of this thriving engineering organization. The educational value to an engineer of such journeys of observation, made in company with his professional associates, can hardly be doubted; but it may be remarked here that the benefit is not limited to mere gain in technical knowledge or professional acquaintance. The experiences of such a journey, through such surroundings, are comparable in their influence with the study of art or the best literature.

All that part of Canada lying west of Lake Superior has experienced such rapid development during the past half dozen years that it has been difficult for the residents of the older portion of the Dominion to keep pace with it in their minds. It was therefore particularly advantageous to the engineers from Ontario and the provinces farther eastward to gain a birdseye view of the rapid advance which has been made in this new country, thus enabling them to form a clearer conception of the magnitude of this region, whose towns and mines and railways and waterfalls promise many opportunities for the engineer.

WHY NOT SHIP CEMENT IN BULK?

A few of the older readers of Engineering News may recall an editorial published in these columns nearly a score of years ago entitled "Bags vs. Barrels for Cement." To be exact, it was printed in Engineering News of May 21, 1887. At that time the great bulk of the cement used in this country was natural cement, and nearly all of it was packed and sold in barrels. Portland cement cut so small a figure then that it was not even mentioned in the editorial. Most of the small amount of Portland then used was imported, of course in barrels; and the trifle then made in this country was likewise packed in barrels.

In that editorial it was pointed out that on the other side of the water, where wood for packages was even then scarce and high-priced, bags were very largely used for the carriage of cement, and in the Western United States the use of bags had even then gained a foothold. We argued that a great saving could be made if the 5,000,000 barrels of natural hydraulic cement then produced annually could be packed in bags instead of barrels.

As every reader knows, the change which we then advocated, long ago came to pass. Only a very small proportion of the 40,000,000 barrels of cement made in the United States last year was packed in barrels. It is fortunate indeed that this is so, for with our rapidly diminishing timber supplies every change which dispenses with the use of wood is a great public benefit. Were the 40,000,000 barrels of cement, which is now the approximate annual production of the United States, to be all packed in barrels, allowing only 12 ft. B. M. per barrel, it would involve a timber consumption of nearly 500,000,000 ft.

There is, of course, no chance of a return to the wooden barrel for packing cement. On the contrary, the barrel for Portland cement, which 20 years ago was estimated to cost about 30 cts., or perhaps 10% of the value of its contents, is likely in the near future to cost nearly as much as the cement it will contain.

On the part of the cement trade, however, the cloth bag, we understand, is generally voted a nuisance. According to established practice, the bags are not loaned or rented, but are sold outright by the mill—the usual price being 10 cts. each; or 40 cts. per barrel of cement. For bags returned in good condition, the mill makes a refund of 7½ cts. per bag, so that the final purchaser of cement pays 10 cts. per barrel of cement to the mill for the use of the bags in which it is shipped.

Recently a paper bag for cement shipment has been put on the market, and is coming into use to a considerable extent. This bag is charged to the consumer at 2½ cts. each, or 10 cts. per barrel of cement purchased. We have before us a printed circular in which are set forth the advantages of the paper bag over the cloth bag. While the cost to the cement purchaser is nominally the same for either the purchase of the paper bags or the rental of the cloth bags, the cloth bags are stated to involve an additional expense to the cement user in the following particulars: (1) Time and labor in collecting, storing, counting, packing and freight charges on the returned bags; (2) shortage on bags lost or torn. This amounts to considerable proportions on many contract jobs. (3) Loss on cement in transit. It is claimed that a pound per bag may be lost by sifting through in transit; (4) cement left in bags through carelessness in emptying. This may reach considerable proportions, particularly if any dampness has reached the bag. A couple of pounds of cement sticking to the bag means a loss of 2% in the total cement used.

Taking all these things into consideration, it is probably not extravagant to estimate the cost of cement packages to the user at 15 cts. per barrel; and this, be it noted, is a total loss. The cement producers, we are reliably informed, make no profit on their charge of 2½ cts. per bag, as by the time the bag has paid for itself it is worn out and unfit for further use.

The paper sack obviates many of the above disadvantages; but will not, of course, stand the rough handling in shipment and storage that the cloth bag will. An occasional bag will be broken in handling and its contents lost. Another objection from the engineer's point of view, and a rather serious one on some classes of concrete work, is the chance of pieces of the torn bag getting into the mixer and causing a weak spot in the concrete. The circular before us advises as a particular merit of the paper bag that it can be cut open with a hoe or broken across a box or barrel and instantly emptied. But in this process a careless workman is very likely to let a piece of the bag fall with the cement into the mixer, and the resulting weak spot in a concrete floorbeam or column or a wall intended to be watertight, might be a very serious matter. There is, then, some ground for objection to paper bags on the part of the engineer. Besides this, the paper bag has some of the same objections as the wooden barrel. It is to some degree a drain on those forest resources that ought to be so carefully husbanded now against the fast approaching day of serious scarcity. The general use of paper bags for cement would mean an annual consumption of certainly over 100,000,000 lbs. of paper, and the stripping of a large area of woodland.

Study of this subject leads us to propound to cement makers, engineers and contractors the question placed at the head of this article: Why not ship cement in bulk? It has been shown above that even with paper, admittedly the cheapest package, the cement user is paying for packages alone 10 cts. per barrel, or, say, 10% of the cost of the cement itself. The cement manufacturer, too, we judge, is at an expense of 1 ct. to 3 cts. per barrel on account of packing cement for shipment, handling bag accounts, loss on bags, etc. If, therefore, cement could be shipped in bulk, both producer and consumer would make a material gain.

Of course where cement passes through two or more hands, as where cement is sold to dealers in building materials, packages are necessary now, and probably always will be. So, too, for the thousands of small jobs where a few dozen or even several hundred barrels of cement are used, bags are probably as efficient a method of handling cement as could be devised. The opportunity for a trial of bulk shipments comes on great pieces of engineering work where cement is used by the thousand barrels. These works account for a very considerable proportion of the total cement consumption, and the saving in cost that might be made by bulk shipments of cement on such work is well worth study.

Doubtless the first objection that will be made to the shipment of cement in bulk is that it ought not to be exposed to the weather. As a matter of fact, however, cement shipped in bags, either of cloth or paper, must be protected from the weather from the time it leaves the mill till it enters the mixer or mortar bed. It must be carried in tight box cars on the railway and hauled by wagon either during clear weather or else in covered vehicles. When stored it must be protected from rain or dampness quite as much in bags as if it were loose.

It is said that cement is more easily handled in bags than it would be in bulk; but this is only true when the handling is in small quantities. With modern appliances for handling bulk materials, such as belt and screw conveyors, it is much cheaper to handle material in bulk than in bags. In the modern cement mill the cement materials and product are never moved by human muscle or hand tools from the excavation of the raw rock or clay until the finished cement is put into bags. Shipment of cement in bulk, would enable the cement maker to spout the cement direct into the car from his storage bins.

So, too, at the point of delivery it would be a simple matter to arrange automatic carriers to take out the load from a car and deposit it in storage bins on the work, at all places where the cars can be run directly to the site of operations. Where cartage is necessary, the delivery could be into tight covered wagons, or carts, arranged to dump their load at destination, somewhat on the plan of some of the carts now used for collecting and hauling garbage.

It is true that at the mixer it is now customary to proportion the ingredients of concrete by counting the number of bags of cement put into a batch. With cement in bulk it would be necessary to measure the cement as is now done with the stone and sand; but would not this be an advantage rather than otherwise? At present the quality of concrete, even on the most important works, depends on the chance that the man at the mixer who puts in the cement keeps correct tally on the number of bags put into each batch. Is this man always infallible? In the haste of untying and dumping in the bags of cement, does it not at times happen that one bag too many or one too few goes into the hopper—and no one is the wiser? Are there not advantages in measuring cement instead of counting bags?

There is another aspect of this matter which should interest the engineer. On small works the cement usually passes through a dealer's hands and is sufficiently seasoned before reaching the work. But on large works, of the class we are considering, the cement often goes

straight from the mill to the work, with very little "aging" unless special provision for storage is insisted on by the engineer. In such work it would be an advantage to have the cement shipped in bulk and freely exposed to the air instead of packed in bags of cloth and paper. This is particularly the case because of the thorough mixing which the cement would or could receive in loading into the car and in unloading.

And this thorough mixing should further simplify and make more certain the work of the testing engineer. At present tests are made by taking samples at random from one bag in so many. It is a mere chance whether or not the bags sampled are representative of the whole shipment. But it is to guard against an occasional small lot of poor cement, more than anything else, that tests are made. One of the stock objections to concrete is that a single barrel or bag of poor cement may be put into some place on the work where high quality is essential. The cement tester, sampling only one bag in many, may miss this poor bag entirely. The engineer is not so much concerned whether the cement varies 100 lbs. one way or the other in tensile strength as he is that no unsound cement shall show up on any particular part of the work.

Now with cement shipped in bulk, each carload will be thoroughly mixed, and the contents of several cars will be mixed in the storage bins on the work. The cement tester can take samples from all parts of these storage bins and be sure that the quality is kept up to specification.

We submit this matter to the consideration of cement manufacturers, engineers and others interested in the use of cement on a large scale; and shall be glad to receive discussion from our readers and particularly reports of any actual experience in the shipment and handling of cement in bulk. That there would be difficulties in the introduction of the practice, we can well understand, and some of them, indeed, we have pointed out. The advantages to be gained, however, seem important enough to justify a trial of the plan.

LETTERS TO THE EDITOR.

The Amount of Water Used in Fighting Fires in New York City.

Sir: In your issue of Sept. 13, 1906, on p. 281, you discuss the quantity of water used in fire fighting, and refer to figures taken from the report of the New York Department of Water Supply, Gas and Electricity. I note that in the cases cited the amount of water used is 15,000 gals. per hr., or 250 gals. per min. On page 271 of the same issue there is a table giving the discharge in gallons per minute of a hose stream, from which it would appear that the discharge from a 1⅛-in. smooth nozzle discharging under an effective pressure of 45 lbs. would be 247 gals. per min., practically the same amount. It would therefore appear that in the cases cited the fires, one being even so serious as to continue for 4½ days, were brought under control and extinguished by the use of only one hose stream. Do you think this can be true?

Yours very truly,

Ira W. Sylvester.

Alexandria, La., Sept. 18, 1906.

[By communicating with Mr. I. M. de Varona, M. Am. Soc. C. E., Chief Engineer of the Department of Water Supply, Gas and Electricity, New York City, we have learned that the figures cited were given to the department named by the New York Fire Department, in response to an official request, and were accepted as correct without question, as was perfectly natural under the circumstances. The figures were not used as a basis for any specific calculation, and even though much too small, would not affect the main point which they were used to illustrate, both by Mr. de Varona and by us: the relatively small quantity of water used in fighting fires. Nevertheless, we are indebted to Mr. Sylvester for calling our attention to the seeming anomaly, for while it would not necessarily follow that his comparison proves the New York figures to be wrong, yet a detailed examination of them shows that in the case of every fire cited the total water consumption given, equals the product of the number of hours' duration of the fire by 15,000 gals.: or in other words, the New York Fire Department seems to have assumed that every fire requires an average of one moderate fire stream during its total duration, which is manifestly an error.—Ed]

More Information Needed on the Cost of Maintenance of Timber Trestles.

Sir: There is much available information bearing on the design of railroad trestles, but less on the subject of their maintenance than its importance would seem to justify. The repairs and renewals of timber trestles involve many small expenditures, determined more or less on the judgment of the bridge foreman, which, in the aggregate, amount to a large yearly expense; and it is a matter of some importance that the work be done in conformity with a correct system, so that the structures may neither be repaired beyond the time when they should be renewed, nor renewed in a year when it would be more advantageous to repair them.

The conditions of service vary in different trestles; the durability of the parts of the same trestle is different; and the cost of labor for details of repair work and for new work are quite unlike; so that the decision of the time when it becomes sound economy to stop repairing and rebuild must necessarily rest on educated judgment.

The annual report of bridge inspection on a railway demands *somebody's* attention to a mass of details and recommendations which he has no time to investigate thoroughly, and which is apt to mean a good deal of money, and his only protection against bad judgment in minor cases is some reliable generalization as a way of fixing a proper limit to repairs.

It is evident that since a trestle can be maintained indefinitely by a system of repairs costing for labor from twelve to thirty dollars per thousand feet of timber, while it can be rebuilt with a labor cost of, say nine dollars, there must be some stage at which it pays to rebuild, quite aside from the question of the greater fire risk in old structures.

It is safe to assume, as a good basis for conclusions, that the annual cost, determined by dividing the first cost by the number of years which experience shows the trestle will probably last without extensive repairs, should never be exceeded, or, in other words, that the cost per year of construction and repairs should never be greater than that of construction alone.

Such a method involves experience of the life of timber under the special conditions, and sound judgment, but the necessary information is usually available for fixing the approximate yearly value of a structure, and, if that is the case, it should be easy to avoid excessive repair work as well as premature renewals.

If trestles could be built, like the "one-hoss shay," with uniform durability in all their parts, there would be an advantage due to the difference of cost of repair work and new work, and it follows that some additional first cost is warranted in new work, in order to defer the time for repairs.

Thus, heart cypress piles are in many situations cheaper in the end than oak piles, notwithstanding the difference in cost, because they will outlast two decks, while the decay of oak piles at the ground line may give concern before the first deck requires renewal; and again, the weak point of pine stringers being the end bearing, it is better economy to pay a higher price for sticks with all-heart bearing edges, than to use those with sap corners which will require replacement before the body of the stick has decayed.

There are cases, of course, where a railway company may dislike a policy of maintenance that looks too far ahead; but the smaller trestles will certainly be kept up at the least average annual cost if periods of at least ten or twelve years are considered, and they are never permitted to reach a condition which demands very frequent or rather extensive repairs.

Respectfully,

Daniel Bontecou.

606 Postal Telegraph Building, Kansas City, Mo., Sept. 28, 1906.

On the Margin of Safety in Bridges and Other Steel Structures.

Sir: Referring to your editorial, "Factors of Safety," in your issue of Sept. 6, I cannot agree to your statement that the unutilized material is "in amount always *more than the utilized material.*" This is not true in such structures as bridges and buildings, as will be seen by the following:

According to present and approved methods of designing, careful estimate is first made of all the loads which the structure may have to carry. These include dead loads, moving loads, impact loads, wind loads, traction loads and centrifugal loads, so that, as far as may be, all forces tending to destroy the structure are known. The sum of these loads, or various probable combinations of them, are then used by accepted methods of computation to find the maximum stress produced by them in each member. In adopting live loads and impact loads, it is generally intended to have them somewhat larger than the maximum requirements at the time of the design, in order to allow for some increase, as past experience shows that moving loads (and especially railroad loads) are constantly increasing. It is only after completing all investigations of the loads and all computations to give the effects of these loads on each member, that the strength of the material in the structure need be considered.

The usual material for structures is "medium steel," with an ultimate tensile strength of 60,000 to 70,000 lbs. per sq. in. and an elastic limit not less than one-half the ultimate strength, or at least 30,000 lbs. per sq. in. As all formulas used in structural designing are based on the elastic properties of materials, it is really only this elastic limit which is seriously considered in fixing the allowable unit stress, and not the ultimate tensile strength of the material.

The allowable unit stress used for medium steel by C. C. Schneider, late Chief Engineer Pencoyd Bridge Co. and now a Vice-President of the American Bridge Co. (and last year President of the American Society of Civil Engineers), was 17,000 lbs. per sq. in. Mr. Schneider is certainly one of the leading structural engineers of the country and his practice, being that of the largest bridge company, is applied to perhaps more structures than any other. The elastic limit of 30,000 lbs. per sq. in., which is strictly in accordance with standard specifications for medium steel, is only 1.76 times as great as the working stress adopted by Mr. Schneider and in use on thousands of structures built by the Pencoyd and American Bridge Companies for years past. As the basis of all structural design and of all formulas used in such design are the elastic properties and elastic strength of the metal, it is evident that the term "factor of safety" as applied to the ratio between working stress and ultimate tensile strength, is erroneous and gives no true idea of the safety of a structure; also, that the amount of unutilized material in a structure, viewed in the correct way, is only 76% in excess of the amount used instead of being "more than the utilized material."

Various considerations relating to structural design show that this excess of 76% is a necessary one. When engineers attempt to foresee future increases in loads, past experience proves that they seldom anticipate the full amount of increase. Some allowance (or some portion of the unutilized 76%) is always advisable to meet unforeseen rapidity in the increase of loads. Even after the loads have been fixed with a fair degree of accuracy, the stresses which these loads will bring upon the different parts of the structure are to some degree indeterminate, as structures will not act in complete accordance with the accepted methods of computation. Again, after the stresses have been computed with as much accuracy as practicable for the main members and the most important details, there remain many secondary stresses which are difficult to compute and sometimes hard to foresee. Stress cannot occur without strain and any truss carrying loads must become somewhat deformed in doing so; and this deformation causes many secondary strains which are not considered in calculations. It is easy to see how, with riveted joints, a slight truss deformation will cause eccentric action and secondary stresses in the joints—and even with pin-connections, the pin-friction will have to some degree the same effect. Each of above stress considerations must be provided for and will utilize some portion of the "unutilized" 76%.

Passing to the strength of the metal, the specified ultimate strength and elastic limit are those required in test pieces, and in full-size and built-up members a less average unit-strength exists. The elastic limit, as frequently determined, is "the fall of beam" rather than the true elastic limit and is often much in excess of the latter. Finally, the number of pieces tested for any structure (including both test-pieces and tests of full-size members) is small compared to the total number of pieces in the structure—and harmful inequalities in steel, though now less frequent than formerly, must still be guarded against to some degree. Again, each of above considerations of the steel must be provided for and will utilize some portion of the "unutilized" 76%.

It is thus seen that in a true sense the amount of "unutilized" material in any structure is *not* "more than the utilized material"; that even if only the adopted loads, the computed main stresses and the test-piece strengths of the steel are taken into consideration, the "unutilized" strength is still only 76% of the "utilized"; and finally, that a large proportion of this 76% of extra strength is *actually utilized* by stresses and weaknesses of the material which (while seldom computed and in some cases indeterminate) are well understood to exist, are no less real because they are not expressed quantitatively, and must be provided for with certainty in every structure.

Edwin Duryea, Jr.,
M. Am. Soc. C. E.

1368 Geary St., San Francisco, Cal., Sept. 19, 1906.

Notes and Queries.

Information is desired concerning Mr. C. Vincent Peterson, formerly Assistant City Engineer of Houston, Tex., and in 1905 connected with the Department of Public Works of the Panama Republic. After a short term of service with the Isthmian Canal Commission, in the fall of 1905, Mr. Peterson returned to the United States and was heard from in Washington on Jan. 1, 1906, and in Brooklyn on Jan. 4. He went thence to Mexico and letters were received from him at Tampico, Mex., Jan. 13, and at Paredon, Mex., on Jan. 22. He appears to have been engaged with Hampson & Smith, railroad contractors, but is reported to have visited their office in the City of Mexico and resigned his position on account of ill health the last of January.

THE SECOND ANNUAL EXCURSION OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS:—MONTREAL TO VICTORIA AND RETURN.

By reason of the organizing ability of its efficient secretary, coupled with the liberality of the Canadian Pacific Railway Co., the Canadian Society of Civil Engineers has carried to a successful ending an excursion without a parallel, so far as we recall, in the annals of engineering societies. And it is only over the border in the home of the Canadian civil engineer that such a tour is possible.

An excursion to Sidney, Nova Scotia, in 1904, encouraged the Society to an even more ambitious undertaking, and in 1905 the idea of a trip to the Pacific coast was broached. But on account of the exhibitions at Portland, Ore., and at New Westminster, B. C., the rolling stock of the Canadian Pacific R. R. passenger department was so fully occupied that the projected tour had to be deferred to a more convenient season, which, happily for the Society, was not long delayed. Hence it was that after the exercise of diplomacy with the railroad company and the usual laborious correspondence with members which such an enterprise entails upon the organizing department of the Society, the excursion was finally started westward from the Montreal station of the Canadian Pacific R. R. at 10 a. m. on Sept. 8, with a schedule covering a distance of travel, outward and return, of 6,447 miles—of which 347 was water and 6,100 rail—to be accomplished by the close of the month.

The Western members of the Society joined the party at North Bay, to which junction with the Canadian Pacific R. R. their coach was hauled over the Grand Trunk Ry. from Toronto, free of charge, and the completed train then consisted of, besides the engine, a baggage car, a tourist car for the use of the train crew, a dining car capable of seating 30 at the tables, and three sleeping cars. At Revelstoke the private car of the Chairman and Consulting Engineer of the Temiskaming Railway Commission was attached, and later the private car of Division Engineer J. E. Schwitzer, in charge of the Canadian Pacific R. R. Division from Fort William to Vancouver. Thus there was finally a heavy train of eight coaches, which were hauled almost across the continent and return free of charge by the Canadian Pacific R. R. Co. With the exception of local train conductors and engine crews, the train employees made the entire trip without change, and it is only on this one railway of the entire world that such an ocean to ocean trip is possible, unless we admit the Siberian Ry. into the competition.

While the entire train was given to the Society without expense for fares, there was a charge of $60 for lower and $40 for upper berths in the sleepers, with a corresponding extra charge for "drawing-rooms"; in the dining car the cost per day would average $2.50 at the minimum, for three meals per person; on the water trips the cost averaged over 3 cts. per mile, and of course when the party enjoyed the agreeable change from sleeping car to hotel bedrooms there were usual hotel rates to be paid. A low estimate would place the cost for the entire tour between $165 and $200 per person, or about one-half what it would cost the individual traveler at regular rates to make the same journey with the attendant expenses of living. "Tipping" of employees was not allowed; an estimate was made at the close of the trip and a generous allowance was awarded to each man entitled to consideration. The dining-car service was fairly good, when one considers the task of feeding daily neary four score of more or less fatigued people of both sexes, with such stores and cooking arrangements as are possible on an ordinary railway dining car. At Winnipeg, on the outward journey, half a day was allowed for cleaning the sleepers, and at Vancouver and between Revelstoke and Kootenay Landing opportunities for thorough cleansing and airing the train were afforded by several days' absence of the entire excursion party. At the very best, however, a prolonged domicile in a railway sleeping car is fatiguing.

Of the personnel of the party, the most distinguished member was Mr. Octave Chanute, Past-President of the American Society of Civil Engineers, Member of the Canadian Society of Civil Engineers, former Chief Engineer of the Erie Railway, and so well identified with the railway and engineering development of this entire continent as to need no further introduction here. Mr. Chanute is also an enthusiast on aeronautics, and he assured many members of the party that the flying machine was an accomplished success as fully demonstrated to his personal knowledge; unfortunately, however, it had already been pledged to military service exclusively. Mr. Chanute, with his two daughters, Mrs. Boyd and Miss Chanute, occupied a "drawing-room." John Bonsall Porter, Professor of Mining and Metallurgy at McGill University, a mining engineer of more than local experience, was the able assistant of Secretary McLeod in the conduct of the excursion, especially in the mining region of the Kootenay District. Among other notable members of the party may be mentioned Cecil B. Smith, Vice-President Can. Soc. C. E., Chairman of the Hydro-Electric Commission of Ontario, and also Chairman and Consulting Engineer of the Temiskaming Railway Commission, an Ontario Government colonization enterprise running north from North Bay (at present with 173 miles of track) and secondarily intended to facilitate the construction of the new Grand Trunk Pacific R. R.; Charles H. Mitchell, Engineer of the Ontario Power Co. at Niagara Falls, Ontario, and an expert in hydro-electric power transmission problems; H. N. Ruttan, City Engineer of Winnipeg; James C. Kennedy, of Owen Sound, and William Kennedy, Jr., of Montreal, both hydraulic engineers of international reputation, and now engaged in the development of large hydro-electric power enterprises on the Pacific Coast and in the vicinity of Fort William on Lake Superior; William J. Sproule, Assistant Engineer, Harbor Office, Montreal; William Duval Baillarge, City Engineer, Quebec, who apparently has succeeded to his office by inheritance from his distinguished father, who used to write quaint books on mathematics and incidentally scold the City Fathers in his annual reports to that good-natured body.

The moving spirit of the whole expedition was, however, Mr. Charles H. McLeod, Secretary of the Society and Member of the Council Can. Soc. C. E., Professor of Civil Engineering, Vice Dean of Applied Science and Director of the Observatory and College Grounds of McGill University, and in absolute charge of the excursion to the Pacific Coast. Professor McLeod is a born organizer, singularly quiet and self-effacing but watchful and insistent, a man who "gets there" without fuss or noise; he kept all the varied details of such a perplexing expedition well in hand, and from start to finish there was a complete absence of the friction, annoyance or unpleasantness which sometimes crops up in the conduct of so lengthy an excursion.

The party was essentially one of young men, with reputations yet to make; they were a company of bright, self-reliant and rather serious-minded men, who were out on an excursion to a hitherto unknown region (to most of them); and the energy and enthusiasm with which they climbed and tramped to whatever was worthy of exploration was quite appalling to the more indolently disposed. The party numbered 77, of whom 27 were ladies, whose presence was certainly the salvation of the expedition, as by their cheerfulness and intelligent companionship they relieved the inevitable monotony which a large company of men only will gradually sink to after a few days association. Most of the ladies climbed the hills, followed the guides through every smelter, peeked into every mine whether on hilltop or at bottom of sunken shaft, and two of them bravely followed the procession, lamp in hand, which explored a bituminous coal mine at nine o'clock at night; it is to be hoped they learned enough of soft coal mining to repay them for the uncomfortable 1,000-ft. tramp they endured.

The journals represented on the excursion were the "Canadian Engineer," "Canadian Machinery" and "Engineering News." Local dailies chronicled the arrivals and doings of the excursionists at the several "lay-over" places, so that the party was well advertised.

The special excursion train was run as Section No. 2 of the "Imperial Limited," which is due in Vancouver four days after its departure from Montreal. At North Bay the special proceeded ahead of the Limited, running along the north shore of Lake Superior and stopping only for change of engines, for water, or for meeting eastbound trains, until Winnipeg was reached at 9 a. m. (Central time) on the 10th. The party was the recipient in this city of many courtesies extended by officials of the city and of the Canadian Pacific R. R. Co. A visit was made to the Canadian Pacific R. R. shops and the city water-works; a luncheon was given at Deer Lodge by the city, and later the party were guests at a garden party given by City Engineer Ruttan and Mrs. Ruttan.

Our readers must pardon digression from this narrative of a notable excursion, to record something of a strictly personal nature. While the writer was passing the town of Renfrew—186 miles from Montreal and 70 miles from Ottawa—he recalled his first acquaintance with that thriving town. It was before daylight on a crisp, frosty morning in the early part of November, 1860, that, with a 15-lb. pack on his back, supported by a thumpline over the forehead or chest, the writer started out on his professional career. His immediate task was to cover by walking a distance of 33 miles on a government road through an almost continuous forest, to the first tavern where accommodations for the night were obtainable. Settlers were few and far between, and it was a dismally lonesome, solitary excursion for a youth fresh from college and home. But the distance was covered by 6 p. m., to be followed by 15 miles more the following forenoon, when the "apprentice" reported to his "master" on a survey which the latter was making for sundry settlers. It was a tough experience, but an adventure in backwoods life worth remembering. The writer had never been in Renfrew since that early day until in the style and comfort of this up-to-date transcontinental trip he passed the station which called up such a host of memories. The "master," P. L. S., is now a wealthy man in Chicago; the "apprentice" founded Engineering News.

The city of Winnipeg is the metropolis of all Canada between Lake Superior and the Rocky Mountains. Its growth has been phenomenal. The most important problems of civil engineering with which it has to deal are its streets, sewers and water supply; the two last are now well developed; the other will scarcely keep pace with the needs of the increasing population. There are some well-paved streets, but the mud of Winnipeg is a "sticker"; it is greasy, slippery, and will not surrender to ordinary treatment. Mr. H. N. Ruttan has been the City Engineer from the creation of the office, and to his efficiency, is due the creditable showing of the existing public works of the city. Winnipeg is the banking center of the greatest wheat growing region of the world, and the numerous fine buildings in which these branch banks are housed form the most distinctive feature of this pros-

perous metropolis. The Canadian engineering party was welcomed on arrival by the Mayor and a committee of aldermen, and many courtesies were extended the party on behalf of the city.

Winnipeg is 700 ft above sea level; it is 1,422 miles distant from Montreal and has a population of 95,000. The Canadian Pacific R. R. has its chief land office here, and has also the finest hotel building—the "Royal Alexandra'— in all Canada.

A passing view of the vast wheat-growing farms was afforded in the morning before reaching Winnipeg. As far as one could see, the steam threshing machines were at work, while many square miles of stooked grain awaited the coming of the threshers. Great mounds of straw dotted the cleaned-up fields; on a prearranged night the whole prairie would be illuminated with the burning of these piles.

Leaving Winnipeg at midnight of the 10th, the important cities of Brandon, Regina and Moose Jaw were stopped at for brief intervals only. Calgary, 2,262 miles from Montreal, and at an altitude of 3,428 ft., with a population of 15,000, was reached at 9 a. m. on the 11th (Mountain time), and the party was allowed until 4 p. m. to see the place and take a drive over the irrigation works of the Canadian Pacific R. R. in this neighborhood.

This irrigation scheme is the greatest in mileage of ditches and cubic yards, excavated and to be excavated, of any similar work on the continent. It is entirely an enterprise of the Canadian Pacific R. R. Co., whose lands only it is intended to water. It is the special project of Mr. J. S. Dennis, who is now the Chief Engineer of the work and who kindly conducted the party over the works and explained everything of interest. The enterprise was fully described in Engineering News of April 27, 1905.

Calgary is a live frontier city; everything is "booming"; business property in the center of the place is held at $500 per front foot, and farm lands within 15 miles radius are rated at $15 to $30 per acre. The newspapers are monopolized by real estate advertising, and the price of labor and materials for buildings is at top notch, carpenters receiving 62½ cts. per hour, while trade unionism rules the situation. A Calgary branch line from McLeod on the south to Edmondston on the north opens up a very rich section of Alberta, which is now much advertised as the coming wheat region next to Manitoba.

At Calgary the white peaks of the Rocky Mountains first come into sight. The line of the railway from Calgary west follows the Bow River through the foothills, rising continually until at a point called "The Gap," the train sweeps into the Rockies between vertical walls of dizzy height. The altitude of the railway here is 4,232 ft., and the distance from Montreal 2,324 miles. From this point to Vancouver—580 miles—there are scenic marvels, mountain and tarn, slow moving glaciers and turbulent torrential rivers, rock cliffs and forest-covered heights, through which the railway winds its way, a mere scratch on the mountain side, or slender ribbon in the valleys. From The Gap it follows the Bow River to a point just beyond Laggan, where it leaves this stream to follow up a small branch—Bath Creek—to the summit 5,379 ft. above sea level. Then commences a descending grade through the famous Kicking Horse Pass, and following this course of the river of that name (called also the Wapita) to its junction with the great Columbia River at Golden, where also the famous Selkirk range of mountains come into view.

We have no intention to "enthuse" here over the well-advertised scenic attractions of the Canadian Pacific Railway; there is "scenery to burn" all along the line, from North Bay to Vancouver, in fact a great deal of it was either already burned or was burning. For the benefit of the passing tourist, the railway company publishes most interesting descriptions of all these attractive features of their wonderful route across the continent, which may be had for the asking; our purpose in this narrative is to report briefly the proceedings of a pilgrimage of civil engineers over a transcontinental highway which is itself one of the greatest monuments to the engineering profession that this continent contains.

Darkness had just fallen when the excursion train halted at the widely-advertised station of Banff, where the party was scheduled to remain from 7 p. m. on the 12th until 1 p. m. on the 13th. A number of the athletic "cranks" walked to the hotel, over one mile distant, but to the majority of the party a constitutional on the station platform, with the surrounding snow-clad peaks to talk about and to guess their altitudes and distances, was all sufficient. There was a wagon ride past the hotel the next day and over an excellent government-built road through the mountains; several of the party also made an excursion with ponies and guides to an observatory on the side of Sulphur Mountain at a height of 7,484 ft.; this party, including three ladies, were so entranced with the views from the mountain bluff that their return delayed the train start for two hours. A herd of 68 buffalo is also one of the Banff attractions, a view of these once "monarchs of the plains" concluding the interesting carriage ride. The National Park for which Banff is the station is a reservation of 5,732 square miles—half as large again as the famous Yellowstone Park. Banff is 2,343 miles from Montreal, and its altitude is 4,521 ft. above sea level.

At Laggan, where the Western or Pacific Division of the railway commences, and watches are set back one hour to Pacific time, the party arrived about 4 p. m., to be taken in carriages 2½ miles up the mountain-side to Lake Louise, a most beautiful sheet of water 5,675 ft. above sea level, and so clear as to reflect perfectly the glacier coming down to its very edge; the more enterprising climbers of the party visited Lake Agnes, near by, and almost 1,200 ft. higher up; there is a fine hotel at the side of Lake Louise, and here the party dined before returning to the train.

Laggan is 2,378 miles from Montreal, and its altitude is 5,037 ft. In the succeeding six miles the train climbs slowly to the summit, an additional height of 284 ft., and reaches the "Great Divide," whence the streams flow in opposite directions to Hudson's Bay and to the Pacific Ocean. At Glacier House Station a halt was made to allow the party time to visit the great Illecillewaet Glacier, about half an hour's walk through the forest; close by rises the abrupt pyramidal mountain called Sir Donald, 10,808 ft. above sea level, and the highest of the Selkirk range, through which the party was now traveling.

Shortly after leaving Glacier House the grade descends around a loop, and at 2,525 miles from Montreal, Revelstoke, or the northern gateway to the mining camp of West Kootenay, is reached, and by 8 a. m. on Saturday—one week from the hour of starting—the train ran alongside the station platform at Vancouver.

It was a long journey and a fatiguing one; but the wonderland which had been traversed and the eight or ten natural obstacles which had been overcome by engineering talent and patience, backed by courageous capital and energetic contractors, had so helped to beguile the time that the crossing of a continent had proved but as a summer's day outing as compared with the stories of the weary months of hardship endured by the pioneers of a generation ago.

There is a singular fascination about the spectacle of these companies of young and hardy men, with transit and chain, level and rod, plunging into the lonely Canadian wilderness and searching hither and thither for an acceptable location for the great steel highway that was to girdle a continent. To the observing tourist of to-day, looking from the window of his comfortable coach into the tangled and dense thickets north of Lake Superior, it must seem a mystery how the engineer could pick out such a favorable route for his line. The bare prairie seemed "dead easy"; but once entangled amid the mountain ranges the mystery of a feasible route could not fail to deepen. And what hardship and suffering from heat and cold and rain and all manner of vicious insects, from weariness of body and mind, the pioneer explorers must have undergone. The civil engineer and the locomotive are two of the greatest civilizing forces of the world; their mission is always to clear away obstacles, to make smooth the path of progress for the thousands who are to follow them.

The Canadian Pacific Railway was a bold undertaking for the time; the country to be traversed by its transcontinental line was an unknown region, and the most of it was, as it is now, a wilderness, peopled only by wild game and the few aborigines who led a most forlorn existence. For a full thousand of miles even now it is hard to imagine a ton of freight originating for transport, and it is only by looking over the whole vast territory served by this railroad that the observer can trace the success which earns the dividends now declared and paid. The Canadian Pacific R. R. Co. has not only opened up for settlement and traffic an hitherto unproductive region, but it has exhibited much other enterprise worthy of emulation. There are no parasite companies robbing its stockholders; it makes its own rolling stock from flat car to "sleepers," and no tribute is paid to the greedy Pullman Co.; there are no refrigerator lines or fast freight lines; it has also built a chain of first-class hotels across the continent, which are a great boon to tourist travel; it owns its steamboat and steamship lines, it has coal mines and forest lands, a large smelter plant in the Kootenay district; it is liberal in granting facilities for reaching its main line with traffic, and the revenue of its vast acreage of land is added to the income for stockholders. It is a vast octopus, and who will say that in its wonderful accomplishments it has not proved a benevolent one?

A committee from the City Council, together with several engineers connected with the C. P. R. R., met the party at the station and arranged a programme for the day in Vancouver. In the forenoon the ladies were taken in carriages to Stanley Park for a sight mainly of the big trees—specimens of the great forest monarchs for which the Pacific Coast is famous. Other parties were taken by trolley to visit a wooden pipe manufactory and to one of the largest sawmills on the coast. So great is the present demand for lumber that the huge mills of the Pacific Coast are all "sold up" for seven months to come, and at high prices.

After luncheon the whole party, with many additions from Vancouver citizens, were taken for a steamboat ride on Burrard Inlet to visit the works of the Vancouver Power Co., incorporated in 1898 to supply Vancouver, New Westminster and adjoining municipalities with power, light and a general electric service. Water is taken from Coquitlam Lake—the area of which is 2,300 acres, with an altitude of 432 ft. above sea level—through a tunnel 2½ miles to Trout Lake, with an area of 500 acres and an altitude of 400 ft. above the sea level; a concrete dam, with a maximum height of 54 ft. and a length on the crest of 361 ft., increases the storage capacity of Trout Lake; three pipe lines extend from this dam to the power-house, a distance of 1,800 ft., with over 400 ft. drop. The capacity of the power-house is 12,000 HP. in four units of 3,000 HP. each, of which three are at present installed. Pelton water-wheels drive Westinghouse alternators, and the potential is raised to 20,000 volts for transmission 16 miles to Vancouver and vicinity. Provision has been made for an ultimate development of 30,000 HP.

Mr. Hugh L. Cooper, M. Am. Soc. C. E., of New York, was Consulting Engineer; Mr. Wynn Meredith, of San Francisco, was Chief Engineer, and Messrs. E. B. Herman and H. M. Burwell, of Vancouver, were Engineers in Charge of Construction. A handsomely illustrated pamphlet has been published fully describing the chief features of this interesting work, which can be had upon application to the company in Vancouver.

The programme of the excursion was changed

in Vancouver to allow of a visit to Victoria, at which charming capital of British Columbia the entire party arrived at 5 p. m. by steamer on Sunday, Sept. 16. In honor of the visit of Earl Grey, Governor General of Canada, at the same time, the city was arrayed in full gala dress, with arches handsomely decorated, and at night electric illumination of streets and buildings. The Parliament buildings were especially brilliant on Monday night, when a reception was held there by the Governor General, to which the engineers' excursion party was invited.

On Monday forenoon a visit was paid to the abandoned naval barracks at Esquimalt, where also the great graving dock was visited. A 4,000-ton tramp steamer had only the previous day been docked for repair, and the visitors enjoyed the unusual privilege of going beneath this vessel and looking at the effect upon steel plates of an impact with a submerged reef.

The cost of docking at Esquimalt is for vessels of 1,000 tons and under, $300 for the first day and for succeeding days 5 cts. per ton daily; for 1,000 to 2,000 tons, $350 and 4½ cts. per ton daily after the first day; all above 2,000 tons, $400 per day and 4 cts. up to 2,000 tons and 2 cts. on all above 2,000 tons.

In the afternoon a carriage ride of several miles was taken, and after the reception at the Parliament buildings, the party went aboard the special steamer chartered for the return trip to Vancouver, which latter city was reached at 8 a. m. Tuesday. The party were the recipients of many other courtesies in Vancouver and Victoria besides the set excursions just described.

At 10 a. m. on Tuesday, Sept. 18—one day behind the schedule time on account of the visit to Victoria—the special excursion train left Vancouver on its eastbound trip. The whole day's journey was through the wonderful Selkirk range, which previously had been traversed at night. The scenic marvels of this region must be seen—no pen can convey an intelligent idea of their varied grandeur.

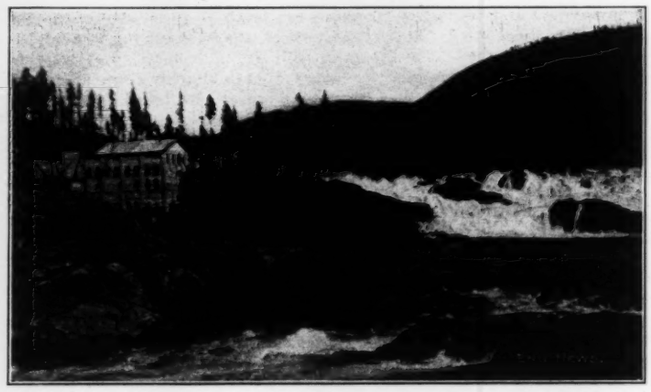
The train turned south from the junction at Revelstoke next morning and arrived at Arrowhead steamboat landing in time for the boat leaving at 11 a. m. southbound. The special train, with the heavy baggage of the excursionists, then returned north to Revelstoke, thence east on the main line to Calgary, south to McLeod, and again west over Crowsnest Pass to Kootenay Landing, where the party arrived at 10 a. m. on the 24th of September.

How many of our readers have heard of the Arrow Lakes or the Kootenay District of British Columbia, and how many are familiar with the mining development of the same region? The writer confesses to personal ignorance of these regions up to the time of his recent visit thereto with the Canadian Society of Civil Engineers. Look, then, upon a good map of British Columbia and note the country lying along the great Columbia-Kootenay River, which belongs to both the Dominion of Canada and our own United States. It is a region of mountains, lakes and rivers, and its total mineral richness, already known to be great, can only be conjectured. All day the Canadian Pacific Ry. Co.'s steamer, with the excursionists on board, plowed the blue waters of the Upper and Lower Arrow Lakes at the rate of 15 to 18 miles per hour during daylight and lesser speed thereafter, to West Robson, where a train in waiting conveyed the party to Nelson, 26 miles further on. A county fair was in progress in Nelson, and this so crowded the hotels of that city that the staterooms of a steamboat were utilized for a number of the excursionists, a decidedly comfortable arrangement for the lucky overflow. During the forenoon of the 19th a boat ride on the Kootenay River took the party to a fine fruit "ranch" and return; then a visit to the fair, where the principal exhibits were sample ores of gold, silver, copper and lead, together with samples of bituminous coal, the products of adjacent fruit orchards and samples of needlework.

Nelson is built on a steep hillside, and we saw no level ground sufficient in size for the usual county fair race track.

Under the leadership of Professor Porter a section of the party visited the Hall Smelter, which is located in Nelson. In this district the yields of the mines are silver, copper and gold.

Several members of the party took advantage of the week's movements to remain at Nelson and recuperate as much as possible from the fatigue of the past journeyings: for the majority of the party a special train of ordinary passenger coaches, thoroughly ample for all needed comfort was furnished by the C. P. R., and hotel accommodations were engaged in the mining towns of Rossland and Grand Forks for the three nights of absence from Nelson. With this train the party visited the Canadian Pacific R. R. Co.'s smelting works at Trail; the mines at Rossland; the rich Granby copper mines at Phoenix and the Granby smelter at Grand Forks; the Mother Lode of the B. C. Copper Co. of New York at its smelter at Greenwood, at which last mining town an especially cordial reception was given the party, concluding with a sumptuous dinner at the leading hotel, with the Mayor and Council as hosts. A few short speeches were exchanged, while the portly landlady, who evidently had a carte blanche order, uncorked Mumm's Extra Dry with most amusing diligence. The dinner was brought to a hurried close by the impatient whistle of the train engineer, who finally rescued the visitors an hour after schedule time and took them back to Grand Forks, where arches and illuminations and committees had been in waiting for the party until so many hours after schedule time had passed that perfect quiet and solitude only greeted the belated visitors, as midnight saw them, tired and sleepy, drawn in omnibuses to their hotel.



CONCRETE POWER STATION OF THE WEST KOOTENAY POWER AND LIGHT CO. AT BONNINGTON FALLS, BRITISH COLUMBIA.

At 2 p. m. on the 23d of September, the special train with the party on board left Grand Forks and returned to Nelson.

If any blasé individual, who has not the skill or courage to run a racing automobile on the Long Island Course, wants a few "thrillers" to enliven his jaded senses, let him buy a ticket over the C. P. R. to Grand Forks, B. C., and return, taking the Grand Forks and Nelson portion by daylight; he will probably get his money's worth after he has looked sheer down from his car window into abysses 100 to 700 ft. deep without a friendly bench to break a possible fall.

A visit was made to Bonnington Falls to examine the new power-house and machinery of the West Kootenay Power and Light Co., where also the party were served with a fine dinner by the Power Co.

The Kootenay River makes a sufficient descent at Bonnington Falls to give a net operating head of 80 ft. on the turbines. The power-house is built to accommodate four 8,000-HP. units, of which two are now being installed. Francis vertical inward discharge turbines, with three runners on the shaft, built by the I. P. Morris Co., of Philadelphia, drive umbrella revolving-field type generators developing 4,500 KW. at 2,500 volts. The current developed will be transmitted at 60,000 volts to the mining districts of Rossland, Phoenix and Greenwood and the smelters at Trail, Grand Forks, Greenwood and Boundary Falls. Messrs. Ross & Holgate are the designing and constructing engineers, and the works are being built by day labor.

The party slept on board the steamboat "Kuskanook" at Nelson during the night of the 23d, as the boat was to leave at 6.30 a. m. next morning; the 52 miles on the Kootenay Lake was accomplished by 10 a. m., and the homeward trip was resumed in the original special train which awaited the party at Kootenay Landing.

The extent and richness of the mining regions traversed during the preceding week were a surprising revelation to the majority of the tourists who were piloted most intelligently and untiringly by Prof. Porter, to whom, as a mining engineer, the region was familiar.

The eastward route now pursued was over the Crowsnest Pass, whose construction is one of the record breakers in the annals of railroading. The altitude at Kootenay Landing is 1,713 ft.; at Moyie, 63 miles from Kootenay Landing, and elevation 2,997 ft., is one of the most valuable mines of silver-lead in the world—the Ste. Eugene Consolidated; at Fernie, the center of the coal industry, a stop was made to look at the coking ovens. The railway continues along up the Elk River to Michel, where it follows the creek of that name, twisting about through the mountains until at the "Loop" nearly three miles are traveled to gain 200 ft. in height—the road doubling back on itself to within a stone's throw of its course directly below.

Crowsnest is reached at an altitude of 4,410 ft., and the summit of the Rockies, a short distance east, is crossed at an altitude of 4,427 ft. Crowsnest Lake, at the lower height of 4,390 ft., is credited with being the birthplace of the blizzard, and the Crowsnest Mountain to the north is an isolated, snow-clad rock rising to a height of 7,800 ft., and forms the most prominent feature of the landscape for many miles. Soon after the train finds its way to the foothills and the plains.

At Frank, 15 miles east of Crowsnest, the train was halted for an hour to allow of a visit to a high bluff close by, from which could be had a view of the awful landslide of 1903, an account of which was published in Engineering News of June 4, 1903. Neither pen nor picture, however, could portray the actual scene, and it was quite the most interesting sight of the homeward trip.

Winnipeg was reached at 7 p. m. on the 26th, and left at midnight. Fort William was reached in the afternoon of the 27th, but too late to permit a proposed visit to the power plant at Kakabeka Falls. A steamboat ride to Port Arthur and a trolley ride returning took the place of the omitted visit, and at the City Hall a reception and dance was given, where an opportunity was furnished for meeting many of the society folk of the two towns. North Bay was left behind at 8 p. m. on the 28th, and the tour closed at Montreal "on time" on the 29th.

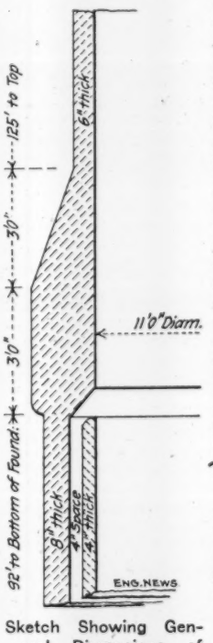
There was not a single accident to mar the enjoyment of the entire trip. While there was inevitable fatigue, there was no actual illness except occasional colds; the weather was unexceptionable, rain falling for a few hours on two nights and one day only. Courtesies were everywhere showered upon the party. A large and valuable store of information relating to Canada and its resources was laid up in the minds and memories of the tourists, and while at first sight the benefit of such a prolonged excursion

may not be visible, yet to the participants it cannot fail of direct beneficial influence on their whole lives.

The writer of this narrative of a remarkable excursion wishes to express his personal obligations for many courtesies extended him by Professors McLeod and Porter, of McGill University; to Mr. Cecil B. Smith, Chairman of the Hydro-Electric Commission of Ontario and of the Temiskaming Railroad Commission, whose guest the writer was on a tour of inspection which enabled him to witness some of the scenes of the new Cobalt mining camp and to penetrate a wilderness hitherto unopened except as to the railroad contractor, the lumberman or the mine prospector; to Engineer John E. Schwitzer, of the Canadian Pacific R. R.; and to Mr. Charles S. Rust, City Engineer of Toronto, who extended most cordial hospitality to the writer on his way from Cobalt to New York via Toronto. It was a genuine pleasure to meet all these very busy men in the full exercise of their many duties, and the writer is glad to make this acknowledgment of the courtesies rendered at some inconvenience to themselves. G. H. F.

THE FAILURE OF A REINFORCED CONCRETE CHIMNEY AT PEORIA, ILL.

The improper mixing and placing of concrete at the junction of the lined and unlined portions of a tall reinforced concrete chimney at Peoria, Ill., seem to have been the causes of the wreck of the upper part of the chimney on Sept. 29, 1906.



Sketch Showing General Dimensions of Reinforced Concrete Chimney at Peoria, Ill., that Failed on Sept. 29, 1906.

The general dimensions of the chimney, particularly at or near the point of initial failure, are shown by the accompanying sketch. It appears that the concrete foundation of the chimney extended some 25 ft. above the ground. The chimney had been completed about three weeks, at the time of the failure, and was a duplicate of another chimney about 40 ft. distant, which had been completed three weeks earlier, or six weeks prior to the completion of the partially wrecked chimney. Both chimneys form a part of the new power-house of the McKinley traction syndicate.

An engineer, who saw the chimney frequently while it was under construction, and who has examined the ruins, writes us as follows:

The portion of the stack which fell contained 16 vertical bars in its circumference. The vertical bars are 1¼ × 1¼ × 5/16-in. tees. The horizontal rings were 1 × 1 × ⅛-in. tees and were spaced 18 ins. apart.

The concrete, or rather mortar, consisted of one part my opinion that much of the mortar was not mixed thoroughly and all of it seemed to be unnecessarily dry. Some of the fragments of the stack which I have examined show that the mixing was poorly done, and the fact that most of the steel rods which are lying on the ground are in a perfectly clean condition, indicates that the mortar did not adhere to them as it would had it been wetter.

As a rule the batches of concrete were so large that it required from two to three hours to place them in the form. Eighteen wheelbarrows of sand and 18 sacks of cement, making about 54 cu. ft. of concrete, were mixed at one time. This was turned by hand twice in a dry condition, and twice after being wet. The contents of one form, 36 ins. high and 6 ins. thick, with an inside diameter of 11 ft., are 53.4 cu. ft., so that each batch contained a trifle more than was needed to fill one form. They usually finished the first section about 10.30 or 11 a. m., and would start on the second section just after dinner, making 6 ft. of stack per day for the portion above the offset.

I broke some of the blocks on the ground with an ax and found that the portion which has a batter on the ouside, where the offset occurs, was much softer than the other pieces. I believe this is due to the fact that no outside form was used on that section, except for the regular 6-in. wall, and on that account it was impossible to tamp it as thoroughly as the rest. The mortar was plastered on in conical layers, against the cylindrical portion.

I have been informed on good authority that the workmen on the chimney had some difficulty in setting the form for the first section above the offset, and that on that account, the batch which was mixed early in the morning was not used until after dinner. If this is true the stack would of course have sufficient justification for falling without the other causes enumerated.

Tests of two carloads of this Owl cement near the beginning of the work showed that the neat briquettes had a tensile strength of about 700 lbs. at the end of seven days and 900 lbs. at the end of twenty-eight days. Briquettes composed of one part of cement and three parts of standard crushed quartz had the strength of about 120 lbs. at the end of seven days and 190 lbs. at the end of twenty-eight days. My opinion is that the failure was not due to poor cement, although it is possible that the cement used was not all up to this standard and it would undoubtedly have been better to have tested every car.

The damage caused by the failure is placed at $7,000 to $10,000, of which some $2,000 was due to injury to the power house. The accident occurred at about 9 a. m., without any warning, it is said. About twenty men were in the power house at the time, but no one there or elsewhere was injured by the falling concrete.

The chimneys were built by the Weber Steel Concrete Chimney Co. of Chicago. Mr. Carl Weber, President of the company just named, is quoted in the Peoria "Herald-Transcript" as having said:

The cause of the collapse of the new smokestack at the new McKinley power house will not be found in any defective material used in its construction, or in any of the plans. Neither did the weather conditions or heavy traffic on the railroads near by have anything to do with the matter. The blame for this disaster lies with the rank carelessness of some one of our workmen in not properly mixing the concrete for that section nearest the collar.

The Peoria Gas & Electric Co. has contracted with the Weber Co. for a reinforced concrete chimney, and Mr. R. S. Wallace, Engineer of the first-named company, is reported to have said that his company will proceed with the erection of its chimney, as planned.

THE HEANY TUNGSTEN INCANDESCENT LAMP has, according to Judge W. F. Bay Stewart, President of the Teter-Heany Developing Co., been developed to such an extent that it now consumes only 0.2 to 0.3 watts per candle-power and has a life of 1,200 to 1,500 hrs. This is a much lower consumption of current than that shown by Tungsten lamps of other manufacturers, the consumption being about 1 watt per candle-power, with a life of 1,500 hrs.

ELECTRIC PUMP EQUIPMENT FOR A DEEP MINE SHAFT.

As an example of the development of deep mine pumping, the large electrically-driven equipment about to be installed at the Ward Shaft, on the Comstock Lode, Virginia City, Nevada, is worthy of note.

The capacity of this installation will be 3,200 gals. per min., against a total head of 1,550 ft., and this will be divided between two units each separately driven by a slow-speed 800-HP. Westinghouse induction motor. One of these units is shown in the accompanying illustration. The pumps are of the Knowles Express type, and are outside end-packed duplex double-acting pumps with plungers 6 11-16 ins. in diameter and 15 ins. stroke. The rotating element of the motor is placed directly on the crank shaft, and the speed will be 195 r. p. m.

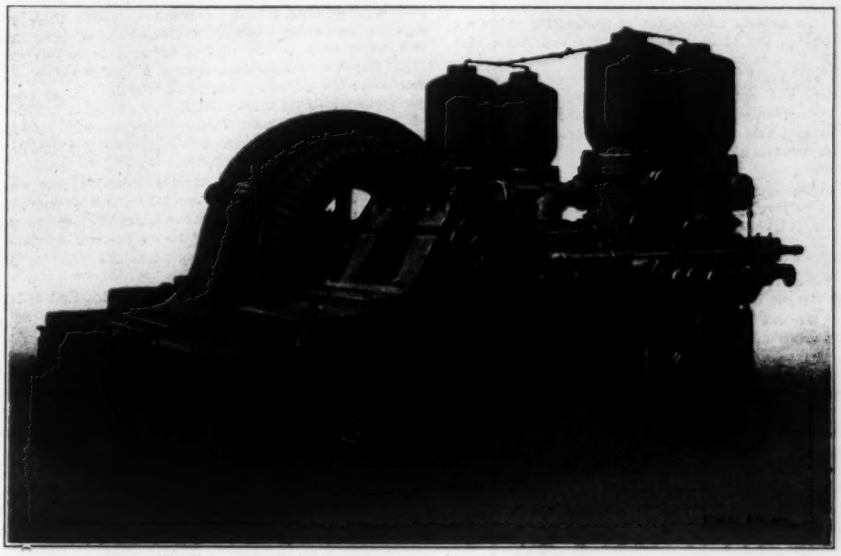
The valves are automatic poppet valves arranged in nests of 13 each. The valve area (103.35 sq. in.) is unusually large so that the consequent movement of the valves will be small to give a high rotative speed with a minimum of wear. The valves, stuffing box glands, and other parts exposed to the action of the water, are of bronze and are arranged so that they may be readily renewed.

The plant will be equipped with a three-stage electrically-driven air-compressor for charging the air receivers, a vacuum pump, and an automatic oiling system. For convenience of erection and repair, the pump station will be fitted with a 15-ton traveling crane.

The over-all dimensions of each pump are: 27 ft. 3¾ ins. in length; 17 ft. in width; and 14 ft. 2½ ins. in height. The motor is 13 ft. in diameter and the steel crank shaft, forged from one piece, is 13¾ ins. in diameter and 14 ft. 4½ ins. long. The total cost complete for operation will be about $125,000. These pumps will be supplied by either one of two centrifugal pumps located in a sump at the bottom of the shaft and operated by special 75-HP. Westinghouse motors on a vertical shaft.

The water will be discharged through a 16-in. steel column with welded steel flanges. The thickness of this pipe varies from ¼-in. at the tunnel level to 9-16-in. at the bottom. The column will be supported by means of heavy iron clamps 6 ins. in length, which, in turn, will rest upon the wall and end plates. To resist the pressure of 675 lbs. to the sq. in., male and female flanges are used and each is fitted with a lead-filled copper gasket.

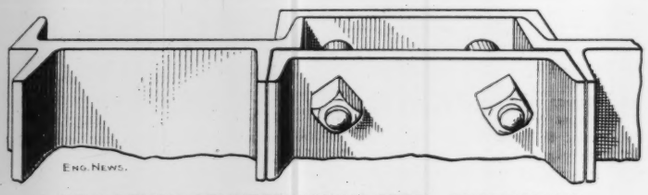
The electric current is supplied by the Westinghouse plant of the Truckee River General Electric Co., and is taken down the shaft at 2,240 volts over a three-conductor lead-covered steel-armored cable of 400,000 c. m. capacity.



A 1,600-GALLON MINE PUMP WORKING AGAINST A 1,550-FT. HEAD, AND DRIVEN BY AN 800-HP. INDUCTION MOTOR.

A NEW DESIGN OF STEEL SHEET-PILING.

The extensive market which has been found for the various forms of steel sheet-piling invented within the past few years has stimulated further efforts in this field. We illustrate herewith a new sheet piling system which was patented on Oct. 2, and is to be put on the market by the National Interlocking Steel Sheeting Co., 70 West Washington St., Chicago. As will be seen, the piling has a channel section and can in fact be made from standard channels by cutting down the flanges and riveting angles on the back. It is expected, however, to have special rolls made to produce the sections. Two standard sections are to be put on the market; a 12-in. and a 15-in., the former weighing 25 lbs. per sq. ft. and the latter 35 lbs. The bolts which clamp the two parts of the intermediate sections together are ⅞-in. on the smaller size and 1 in. on the larger, and are spaced 1 ft. apart.



A NEW DESIGN OF INTERLOCKING STEEL SHEET PILING.

The claims made for the piling are great rigidity with light weight, and correspondingly moderate cost. The joint is made metal to metal and no wood packing pieces are required.

A REQUEST FOR BIDS FOR THE CONSTRUCTION OF THE PANAMA CANAL ON A PERCENTAGE BASIS.

Proposals for the construction of the Panama Canal under a single contract on a percentage basis were issued by the Isthmian Canal Commission on Oct. 9, the bids to be opened on Dec. 12. The desire of the Commission is to secure bids from an association of contractors, including specialists in various lines, rather than from any single contractor. The Commission will supply plant, raw material and various facilities named below. The reasons for adopting the plan just stated have been set forth in an interesting letter by Mr. T. P. Shonts, Chairman of the Isthmian Canal Commission, addressed to the Secretary of War. The letter was dated Aug. 29, 1906, but was only made public, with the invitation for bids, on Oct. 9. The letter in full is as follows:

Washington, D. C., Aug. 29, 1906.

Sir: I beg to transmit a proposed invitation for bids to complete the construction of the Isthmian Canal upon a percentage basis, including as a part thereof, for greater convenience of consideration, the terms of a contract to be entered into thereunder.

As to the general advisability of contracting the work of completing the canal, we know from experience that the difficulties to be overcome in the successful prosecution of any great work are in direct proportion to the magnitude and complexity of the enterprise. Furthermore, experience and observation teach that the best results in any field of human activity are accomplished by those most skilled in that particular field of human endeavor.

The physical construction of the Panama Canal is, all things considered, the greatest task of modern times. It is in the highest degree exceptional in magnitude, complexity, and cost. In order, therefore, to most successfully, economically, and quickly finish this great work there should be associated with the commission the best trained talents of the world in each particular department of the undertaking.

The question may be asked, Why does not the commission gather together experts in each branch of the work, and with them as heads create its own organizations and do the work by day's labor? If the elements of time and cost did not enter so vitally into the undertaking, the commission might do this; but because of the unprecedented and greatly extended industrial activity of the time, and the consequent violent competition for all classes of superintendents, foremen, subcontractors, skilled mechanics, and even ordinary laborers, it would take the commission years to secure men and build up departmental construction organizations which would equal in efficiency those now controlled by the leading contractors of the United States.

If, therefore, the commission, by associating with it the best trained construction men available, can receive the immediate benefit of the existing organizations which these men control, and which they have spent years in perfecting, and can by reason of their assistance complete the canal in shorter time and for less money, is it not the part of wisdom and sound business judgment to do so?

If the wisdom of contracting the work of completing the canal be conceded, the question remains, What form of contract is best? Whether:

(1) To divide the work into sections, and let each part to a separate firm of contractors; or,

(2) To let the entire work to one firm or company on the basis of unit prices; or,

(3) To let the actual work of construction to an association of contractors, each member of which will be an expert in some branch of the work, on a percentage basis.

Before discussing the relative merits of these various forms of contract it may be well to describe the actual work to be done under the agreement.

It is clear that under any character of contract it would be incumbent upon the Government to reserve to itself on the Isthmus the great departments of Government, Sanitation and Engineering. With a complete staff organized for this purpose it is easy for it to assume other obligations scarcely less essential to the welfare of the work, and, indeed, almost a part of its governmental duties. The control of quarters, and of the subsistence department, so directly connected with the health and well-being of canal employees, must be retained directly; or if the subsistence department be turned over to the contractor it must still be subjected to a rigid supervision. In no event can the contractor be allowed to make of this department an independent source of profit. The retention of the entire Commissary Department, needed for the supply of the commission's own men, becomes in this connection further advisable. The elaborate construction plant which the Government has installed, and its maintenance, render likewise expedient the retention of the Department of Materials and Supplies. The Panama Railroad, with its commercial business extending to all parts of the world, cannot wisely be turned over to the contractor. With all these facilities thus retained by the Government, it becomes possible for it, with little additional expense, to supply at a very much lower cost than any contractor could the raw materials for the canal, the careful selection of which, uninfluenced by consideration of profits, is admittedly a matter of first importance.

Upon general grounds of policy, and of an immediate and far-reaching economy as well, it therefore seems advisable to confine the work to be done by the contractor to actual construction. These considerations necessarily exclude the idea of contracting for a finished canal as a whole, where the material, as well as the labor and all other items entering into the cost, shall be furnished by the contractor.

As to the best form of contract applicable to the work of construction proper:

The chief objection to the first proposition, viz., that of dividing the work into sections, and letting each part to a separate firm of contractors, is that there are so many perplexing elements and questions entering into this work, such as the control of labor in supply and price, repairs to and maintenance of plant and equipment, and the necessary conflicting relations of so many contractors to the Panama Railroad, as to make the task of preventing the most serious complications between these antagonistic interests under that plan a hopeless one.

There is also the further serious objection that even after the utmost precautions are taken, one or more of the contractors is certain to prove unsatisfactory, to the confusion and delay of part of the work; and an undue delay to any one part of the work means a delay to the whole.

The objection to the second alternative, viz., that of letting the work as a whole to one firm or company on a basis of unit prices, is that it would cost too much. Any contractor who successfully carries out this great work will be entitled to a fair profit, but to his estimate of cost and fair profit, he must add, if bidding on unit prices, and honestly intending to carry out his contract, a substantial increment to protect himself against unforeseen contingencies and possibly severe losses. The contract thus becomes to a great extent speculative; but while it certainly is not desired that an undertaking of so much consequence as this should be the contractor's ruin, with a consequent disorganization of the work, neither is it desired that it become a source of enormous and unreasonable profits at the Government's expense, as would be the case if the contingencies the contractor guarded against in his estimates did not occur.

This brings us to the consideration of the third proposition, viz., that of letting the actual work of construction to an association of contractors on a percentage basis.

As outlined in the accompanying papers, this plan contemplates a competition for the work between two or more groups of contractors, each group composed of contractors who have achieved a significant success in at least one of the departments of construction involved in the present undertaking and whose combined experience covers the whole task. By the terms of the invitation proposals by single individuals or firms whose experience and whose organizations must be relatively limited are therefore discouraged.

The contractor who receives the award will be paid an agreed percentage upon the estimated reasonable cost of the actual construction work as fixed by an engineering committee of whom the contractor will name two members and the commission three. This committee will likewise, from all available data, estimate a reasonable time for the completion of the canal; and a system of premiums and penalties, to be paid to the contractor accordingly as the work is completed within or beyond such estimated cost and time, is provided for. The amount of percentage to be paid the contractor fixes the basis of competition.

This plan is not novel. It is being employed increasingly by the oldest, largest, and most successful corporations in the country. Its advantages are many:

(1) The Government will get the benefit of the combined efforts of the best and most experienced contractors in the world, each in charge of a department in which he is a specialist and cooperating with other specialists, because all are sharers in results, to bring the whole work to the earliest and most successful conclusion.

(2) The Government will secure the cooperation of these powerful interests in keeping full the ranks of foremen, locomotive engineers, steam-shovel men, and mechanics of all classes and with the best men of each class.

(3) The Government will know exactly what the work costs in every part, and as it progresses, and will know it is only paying a fair and reasonable profit on same.

(4) The plan offers every incentive for speedy and economical construction by penalizing extra time and cost and rewarding better than contract performance as to either. The Government can well afford to pay bonuses on time, as the annual interest saved to it will after five years be double the amount of bonus paid per year.

(5) By retaining control of the work and exercising strict supervision through its engineering force the Government will protect itself against cheap or faulty construction.

(6) The financial responsibility of the association of contractors will be beyond question, and its bond for $3,000,000 will amply protect the Government, in so far as a bond can be made a protection.

(7) The contract will be more flexible. It will not be necessary to settle in advance all the main details of the work which could not subsequently be modified in material respects under any other form of contract save with the consent, perhaps unattainable, of the contractor and his sureties. Wide departures from the general plan may subsequently be made without affecting the real interest of either side. Points which at the outset might otherwise be difficult, if not impossible, to adjust, may be disposed of as they arise.

(8) Friction will be avoided. Claims and counterclaims inevitably attendant upon changes in the plans and specifications with an accompanying train of contentions, will to a great extent be eliminated.

(9) Probable saving to the Government. No great undertaking, covering a long period of time, has ever been accomplished without the discovery, during its development, of new methods and machinery which have shortened the time and cheapened the cost of the undertaking. American inventive genius is not dead; history will repeat itself; and the time and cost of completing the canal as estimated will in all probability be reduced by the application of new principles which will be discovered as the work progresses. It is conceivable that the Government may receive as the fruits of the system of rewards embraced in this plan savings sufficient to offset the entire percentage required to be paid the contractor on the estimated cost of the work.

(10) Finally, a termination of the contract, should it become necessary, would be less disastrous to the contractor, while an effective resumption of the work would be made easier to the Government, owing to its close relations thereto.

In view of the foregoing considerations I strongly recommend that the inclosed invitation for bids to complete the construction of the canal on a percentage basis be issued. Yours very truly,

T. P. Shonts,
Chairman Isthmian Canal Commission.

To the Honorable The Secretary of War.

The proposed form of contract is too long for reprinting in this issue, as it was received just as we were going to press. Some of its more

important features are as follows: It calls for the completion of "an 85-ft. lock-level ship canal, having a minimum depth of 41 ft. and a minimum width at the bottom of 200 ft., between deep water" at either end. Any association of contractors may submit proposals, providing it has an available capital over all debts of $5,000,000. Bids must be accompanied by a certified check, or equivalent, for $200,000, and the successful bidder must give security for $3,000,000 and be prepared to enter into contract within 15 days.

Besides excavating the canal, the work will include: a dam at Gatun and a dam or dams at or near the southern or Pacific end of the canal; all locks and regulating works; removal and reconstruction of the Panama R. R.; quarrying, transporting and dressing stone, making concrete, etc.

The Commission agrees to furnish substantially all plant and machinery required in construction except minor tools, and also all raw materials put into the work, as well as fuel or electricity for power of all kinds. The Commission reserves the right, however, to transfer to the contractor the manufacture of cement or explosives and of the metallic parts of the locks and auxiliary works of the canal. The Commission will also supply free of charge existing construction tracks, housing quarters for employees, warehouses, hospitals, office buildings, and other supplies and facilities. The Commission will retain control of all engineering works, municipal engineering, police, hospital, commissary service, and the like.

The contractor will receive monthly payments "covering the cost of the actual construction work" for the preceding month, and also, with qualifications that need not be entered into here, two-thirds of the agreed percentage of the actual cost of work done each year, to be paid at the close of the year. Upon the completion of the work, the balance on the percentage allowance will be paid, with the following deductions or additions: In case the actual cost exceeds the estimated cost, a deduction of 0.5% from the per centum otherwise payable for each $5,000,000, or half fractional part thereof, of actual cost in excess of estimated cost; in case the actual cost falls below the estimated cost, an addition to the agreed percentage, of one-third of the difference between the actual cost and the estimated cost, will be paid. If the work is not completed within the stipulated time limit, the contractor will forfeit as liquidated damages $100,000 for each month of delay, but for every month gained by the contractor on the time limit he will be allowed $100,000 per month.

The cost and the time estimates are to be made after the award of the contract by a commission of five engineers, of whom two will be chosen by the Contractor and three by the Canal Commission—or two by the Commission, the third Commission member being its Chief Engineer.

Provisions are made in the contract for its termination through default on the part of either the Commission or the contractor.

AN EXTENSIVE TERMINAL IMPROVEMENT is being undertaken by the Chicago & Northwestern Ry. at Chicago, Ill. A plan has been developed for a new terminal station and new approaches, and work on the improvement will be begun at once. The total cost of the new construction, right-of-way and changes involved will be about $20,000,000. The present terminal of the Chicago & Northwestern is located just east of the North Fork of the Chicago River, and just north of the main stem of the river, in surroundings where enlargement is practically impossible. The line crosses the North Fork by a drawbridge, west of which is a junction at which the line to Omaha (westward) separates from the trunk carrying the St. Paul and Milwaukee divisions. The drawbridge, which must be frequently opened and closed to accommodate a heavy river traffic, throttles the train traffic in and out of the terminal, a traffic amounting to about 400 trains per day. Moreover, there is in effect only one route of access to the station from the central district of the city, a drawbridge over the main channel of the river on Fifth Ave., just south of the station. All these difficulties make up a problem which has for some time been pressing toward solution. Mr. Marvin Hughitt, President of the railway, has had the situation under advisement for several years; a year ago he called in as his confidential consulting engineer Mr. John F. Wallace, formerly Chief Engineer of the Panama Canal and now President of the Electric Properties Co., of New York, N. Y. A plan for a new terminal was developed and carefully elaborated. The essence of this plan is a terminal at Madison and Canal Sts., with new approaches from the Omaha line and the St. Paul and Milwaukee line, which approaches do not cross the river, are everywhere unobstructed, and aggregate six tracks at the throat instead of two as in the present terminal. The new terminal will have a width of 16 or 17 tracks, and track room for about 200 cars. It will be accessible from the city by numerous routes, surface, elevated and tunnel. The old terminal at Kinzie and Wells Sts., is to be converted into a freight depot. Other portions of the yards will be rearranged to suit the new conditions. The approaches to the terminal are all elevated, and cross above all intersecting structures except the Lake St. Elevated, whose grade will be raised slightly to pass over the six-track throat at the entrance to the new terminal station. During the past year the real estate necessary for the plan has been quietly purchased by the company, and everything is in readiness for prompt inauguration of construction. The execution of the work will be in the hands of Mr. E. C. Carter, M. Am. Soc. C. E., Chief Engineer of the Chicago & Northwestern Railway Co.

THE PENNSYLVANIA R. R. HUDSON RIVER TUNnel holed through its south tube on Monday, Oct. 8, 1906, at a point some distance east of the point where the headings of the north tube met, but also close to the New Jersey-New York State line. The north tube headings met on Sept. 11, as was noted in these columns at the time. The shields in the north tube are now being taken apart and removed, which work is about half completed at present. The outer shell of the shield, being outside of the lining, remains in place, the closing rings being laid up inside of it. The tunnel is being built by the O'Rourke Engineering Construction Co., under the direction of Mr. Charles M. Jacobs, M. Am. Soc. C. E., for the Pennsylvania, New Jersey & New York R. R. and the Pennsylvania, New York & Long Island R. R., the corporations under whose ownership the Hudson River and East River tunnels and connecting lines for the Pennsylvania R. R. are being built.

THE DOUBLE RAILWAY TUNNEL under Capitol Hill, Washington, D. C., has been completed and turned over by the contractors, the New York Continental-Jewell Filtration Co., to the Pennsylvania R. R. Co., which will now proceed with the laying of tracks. This tunnel forms the southern approach to the new Union Station, now under construction (Eng. News, Nov. 10, 1904, p. 415), and was started Dec. 6, 1903. The tunnel is 4,033 ft. long, of concrete and brick construction, the wall separating the two tunnels being 4 ft. thick.

THE ARMORED CRUISER "North Carolina" was successfully launched at the yards of the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., Oct. 6. She is a sister ship to the "Montana," now building in the same yards, and will have a displacement when fully loaded of 15,580 tons, and a speed of 22 knots per hour. The "North Carolina" is 504 ft. 5½ ins. long, with an extreme breadth of 72 ft. 10½ ins., and a mean draft, fully loaded, of 27 ft. ½-in. The contract price is $3,575,000. Her armament will be as follows: Main battery—Four 10-in. breech-loading rifles, sixteen 6-in. breech-loading rifles and four 21-in. submerged torpedo tubes. Secondary battery—Twenty-two 3-in. rapid-fire guns, twelve 3-pounder, semi-automatic rapid-fire guns, two 30-caliber automatic guns, and two 3-in. field guns. The hull is protected by a water-line belt of armor, 5 ins. thick amidships, tapered to 3 ins. forward and aft.

THE SERIOUS RAILWAY ACCIDENT which occurred at Grantham, England, on the Great Northern Ry., Sept. 19, was briefly recorded in our issue of Sept. 27, p. 341. Additional particulars furnished by our English correspondent follow:

The wrecked train was a fast express due at Grantham about 11 p. m. It consisted of 13 cars, and nearly all of these were carried on trucks; they were corridor cars, connected by vestibules. At Peterborough the engines were changed, the new one being of the Atlantic type, in charge of an engineman of long experience and with an excellent record. The night was clear, so that signals were distinct, and a tunnel and bridge would warn the engineman of the approach to Grantham, which is at the foot of a long down grade. The train was due to stop at Grantham, one part going on by a branch line to Nottingham, and the main part going on to the north. As the Nottingham section leaves first the switches at the junction were set for the branch. Passengers waiting at the station were alarmed at the speed at which the train approached, and surprised to see it rush through, at a speed of about 40 miles an hour, according to the statement of the division superintendent. The train swung around the curve of the Nottingham line (the speed for which is limited to 10 miles an hour by the rules), and the engine appears to have left the rails immediately on reaching the tangent. It knocked the masonry parapet of a bridge into the street below and then turned over and fell on the roadbed; six of the cars went down an embankment 30 or 40 ft. high and were smashed. One of the cars struck on its roof and the heavy steel underframe crushed the sides, injuring and pinioning the passengers. The wreckage caught fire almost immediately, and the fire caused the death and injury of several persons. The rear cars remained upon the track. The continuous vacuum brake appears to have been applied when the train passed the station, as several witnesses speak of seeing sparks flying from the wheels, and the conductor (who was in the third car) states that, realizing the danger, he tried to apply the brakes, but found they were already applied. There is doubt as to whether steam had been shut off. One surmise is that the engineman had gone suddenly insane, but it seems more probable that through some inexplicable forgetfulness or temporary aberration of mind he failed to realize his whereabouts until too late. The application of the brakes indicates that an attempt was made to stop the train, and some of the persons on the station platform state that they saw the engineman and fireman standing in their usual positions in the cab.

FIFTEEN PERSONS WERE INJURED in a rear-end collision on the Long Island R. R., near Broad Channel station, Tuesday evening, Oct. 2. An east-bound steam train had become stalled upon the trestle over Jamaica Bay, due to a broken eccentric rod on the engine. This accident held up a following electric train, steam and electric trains running on the same track, the block signals being set against it. A steam train following the electric train failed to stop, but ran by the signals, and smashed into and derailed the rear car of the electric train.

A CROWDED CAR on the Fordham line of the Yonkers (N. Y.) Electric Railway ran away on what is known as Horseshoe Hill at Lincoln Park, near Yonkers, during the rush hour Monday evening, Oct. 1, and, jumping the track at the curve at the foot of the hill, crossed the street, where it struck a large boulder and turned over, showering the 60 passengers with glass and wreckage. One infant was killed and most of the other passengers injured, one fatally. The accident, according to press dispatches, was due to the brake-rod of the car breaking, when the motorman attempted to apply the brakes at the top of the hill.

A REAR-END COLLISION on the Boston & Maine R. R., at Lansingburg, N. Y., Oct. 4, killed 5 persons and injured some 25 others. An excursion train from Boston was standing at the station, awaiting an east-bound train for Boston, when a special, loaded with members of the Fifteenth Cavalry on their way to Cuba from Fort Ethan Allen, crashed into it. The two rear cars of the excursion train, Pullmans, were split in two and thrown down an embankment, while the third car from the rear was telescoped. The first car of the special was also telescoped. A flagman had been sent back to flag the special, but apparently failed to do his duty.

A BRIDGE DISASTER occurred on the Chicago, Rock Island & Pacific Ry., near Dover, Okla., Sept. 18. A north-bound passenger train plunged off a high bridge into the Cimarron River. The bridge, according to press dispatches, had been moved down stream by the pressure of drift-wood, carried down by the swollen stream. A chair car and two Pullmans remained on the track. The train was running at high speed to make up time, and the engineer was unable to stop in time to avoid an accident, when he saw the condition of the bridge. Eight persons are reported dead and twenty or more injured.

TORNADOES DID MUCH DAMAGE in New Orleans and vicinity Oct. 5. Six persons are reported dead and nine others fatally injured, while the damage to property is placed at more than $1,000,000. The area affected lies within a radius of 100 miles of New Orleans, the storm being divided into several different formations.

AN EXPLOSION in the West Fork mines of the Pocahontas Collieries Co., at Pocahontas, Va., Oct. 3, entombed some 60 miners, of whom 18 are known to be dead. Rescuing parties have failed to find, according to late press dispatches, the remaining men. The cause of the explosion, which took place 2½ miles from the mouth of the mine, is not known.

GAS IN THE SUBWAY excavation at Sixth and Market Sts., Philadelphia, Pa., caused a fatal explosion Oct. 6 which killed eight persons and injured many others. A large gas main, uncovered by the excavation

for the subway, was discovered to be leaking badly, and while the leak was being examined by an inspector of the gas company an explosion occurred. It is supposed that the escaping gas had formed an explosive mixture in the tunnel and that it was fired by the torch of the inspector. The subway was only slightly damaged, while the principal damage to nearby buildings was broken windows. Business was, however, paralyzed in this section of the city, owing to the suspension of the gas, electric and street car services.

FLOODS in the States of Jalisco and Colima, Mexico, have destroyed much property and life. A new steel railway bridge near Tuxpan was destroyed, while much damage was done to railways by landslides. Some 150 persons have been reported drowned.

THE SUMMIT OF MOUNT McKINLEY, in Alaska, was reached for the first time by Dr. Frederick A. Cook, of Brooklyn, N. Y., and a party, on Sept. 15. They found the temperature at the top 16° F. below zero, but as their barometers failed to work they were unable to accurately compute the height of the peak which they ascended. They estimated its height, however, at 22,800 ft. Previous attempts to reach the top of this mountain, the highest on the Alaskan peninsula, have been unsuccessful. Dr. Cook is said to have reached the summit by a new route from the north.

THE REMOVAL OF 13,000,000 CU. YDS. of earth is to be undertaken by the Oliver Iron Mining Co., at Coleraine, on the western Mesaba Range, according to "The Iron Age." The company is to strip 80 acres of land to an average depth of 80 ft., in order to uncover a body of ore estimated to be at least twice as large as the overburden above it. At Holman, a short distance northeast of Coleraine, the same company has started a similar undertaking, which is almost as large.

THE UNITED ENGINEERING SOCIETY BUILDING in New York City is now receiving its interior finish, and contracts for the furnishings and equipment are being carried out. It had been hoped that the building would be ready for use by the American Society of Mechanical Engineers at its December meeting, but some delays in the work have caused the plan to be given up. The building, however, will be open for inspection at that time.

DESIGNS FOR MOVABLE DAMS have been called for by the Austrian Government, and an international competition has been arranged. A type of movable dam is desired for use in the rivers of Bohemia and Galicia, where high floods and heavy ice occur, and the dam must be so designed as to be operative in the winter months. Information as to the conditions of the competition may be obtained by addressing Mr. Emil Timmler, Consulting Engineer, III. Plass Gosse, No. 616, Prague, Bohemia.

THE SNYDER STEEL TIE is to be tried on the main line of the Pennsylvania Railroad, at Blairsville, where a trial order of 5,000 is soon to be laid. The Snyder tie consists of a steel shell rolled in the form of a trough 7 ins. sq., and filled with asphalt at a temperature of 240° F. The tie is laid with its open side down so that the ballast works up into the asphalt, which helps to hold the tie in place in the roadbed. The rails are secured to the tie by clips held by bolts, which are inserted in the tie through slotted holes. A stretch of track laid with these ties has been in use in the yards of the Central Iron & Steel Co., at Harrisburg, Pa., for over a year, and is said to have stood up well under heavy traffic. The tie is made by the American Ry. Steel Tie Co., of 42 Broadway, New York City.

MORE WATER TUNNELS and pumping stations are under consideration by the Engineering Department of the City of Chicago. It is said that the projects include a pumping station at Bowmanville, with a tunnel five miles long leading to the lake; a station near the stock yards, with a 9-ft. tunnel connecting with one of the existing tunnels; and a station at South Chicago, also with a 9-ft. tunnel connecting with an existing land tunnel.

RULES FOR WIRELESS TELEGRAPH MESSAGES in time of war have been formulated by the Institute of International Law in session at Ghent, Belgium. According to these rules belligerents may prevent the transmission of Hertzian waves by a neutral State over the high seas within the sphere of their military operations. All persons taken prisoners while receiving or transmitting wireless messages from belligerent territory or between different sections of a belligerent army are not to be considered spies, but are to be treated as prisoners of war, unless their operations were carried on under false pretenses. Neutral ships and balloons proved to have been used to furnish an adversary with information helpful in the conduct of hostilities may be removed from the zone of hostilities and the wireless apparatus on board seized and sequestrated. A neutral State is not obliged to prevent the passage across its territory of Hertzian waves destined to a country at war. A neutral State has the right to close or take over the wireless telegraph station of a belligerent operated in its territory. Every prohibition in the matter of wireless communication made by belligerents must at once be communicated to neutral governments.

PERSONALS.

Mr. David Van Alstyne, Mechanical Superintendent of the Northern Pacific Ry., has resigned to become Manager of the Dunkirk (N. Y.) plant of the American Locomotive Co.

Mr. W. H. Ham, formerly Reinforced Concrete Engineer for the Tucker & Vinton Corporation, has accepted the position of Concrete Engineer of the General Fireproofing Co. of Youngstown, Ohio, and New York City.

Mr. A. A. Anderson, General Superintendent of the Indianapolis & Cincinnati Traction Co., has been made General Manager of the Indianapolis, Columbus & Southern Traction Co., to succeed Mr. William D. Irwin, resigned.

Mr. Russell L. Huntley, of Omaha, Neb., has been appointed Chief Engineer of the Union Pacific R. R. He was formerly Assistant Engineer, but, since the resignation of Chief Engineer Berry some time ago, had been acting as chief engineer.

Mr. Warren B. Travell, Assoc. M. Am. Soc. C. E., has resigned as Chief of the Estimating and Designing Department of the Robins Conveying Belt Co., of New York City, and has opened offices at Plainfield, N. J., as General Contractor and Engineer.

Mr. Robert T. Hill, formerly with the U. S. Geological Survey, and Mr. Frederick B. Irvine, formerly with the City & County Contract Co., have formed a partnership under the firm name of Hill & Irvine. They will engage in general mining and civil engineering, at 25 Broad St., New York City.

Mr. Charles W. Brooke and Mr. Frank B. McConnell have formed a partnership under the firm name of Brooke & McConnell, to carry on the business of advertising the products of engineering concerns, heretofore conducted by Mr. H. M. Baxter. Their headquarters are in the Lewis Bldg., Pittsburg, Pa.

Mr. C. F. Baker has been engaged by Mr. L. B. Stillwell, Consulting Electrical Engineer, 100 Broadway, New York City, as Superintendent of Power and Construction in connection with an engineering and operating contract that Mr. Stillwell has made with the United Railways & Electric Co., of Baltimore, Md. Mr. Baker formerly held a similar position with the West End Street Railway Co. of Boston, Mass., and the Boston Elevated.

The following changes have taken place in the personnel of the Reclamation Service: Mr. Joseph Wright has been appointed engineer and assigned to Huntley Project, Mont.; Mr. D. G. Martin, engineer, formerly employed on Minidoka Project, has resigned from the service. The following have been appointed engineering aids and assigned as noted: Mr. Frank A. Banks, Lower Yellowstone Project; Wm. I. Boyd, Salt River Project; Roy H. Elsea, D. W. Ross, Boise, Idaho; W. A. Stebbins, Shoshone Project, Wyo.; Arthur J. Strong, Lower Yellowstone Project.

The partnership which has existed since Jan. 1, 1899, between Messrs. J. A. L. Waddell and Ira G. Hedrick, under the firm name of Waddell and Hedrick, Consulting Engineers, will be dissolved by mutual agreement on Dec. 31, 1906. Mr. Waddell will form a new partnership on Jan. 1, 1907, with Mr. John Lyle Harrington, under the firm name of Waddell and Harrington, Consulting Engineers, with headquarters at Kansas City. This firm will engage in practically the same line of work as has been conducted by the firm of Waddell & Hedrick, which covers mainly bridge and structural engineering. Mr. Harrington at present occupies the position of Chief Engineer of the Locomotive & Machine Co., of Montreal, Canada. He was formerly engineer of the C. W. Hunt Co., of New York. His eleven years of practical experience have been pretty equally divided between bridge work in various lines and departments and machinery designing and construction, including notably dredges and coal-handling machinery. He has also designed, built and equipped two large bridge shops. Mr. Hedrick will take up a consulting engineering practice with headquarters at Kansas City. While he will continue in bridge engineering, he will also engage in a more general engineering practice, including the engineering in connection with the promotion and development of new railways, interurban lines, and other enterprises.

Obituary.

William C. Marvin, a retired builder of Brooklyn, N. Y., died at his home in that city Oct. 1, aged 86 years.

Harry J. Jerome, General Manager of the Union Steamship Co., of San Francisco, Cal., and Eastern General Agent of the Union Oil Co., died at Baltimore, Md., Oct. 2, of heart disease.

Karl G. Gilberg, a Swedish engineer of Brooklyn, N. Y., died at Indianapolis, Ind., Sept. 12, of typhoid fever. He was a member of the firm of Gilberg & Hamilton, Electrical and Mechanical Engineers, 29 Broadway, Brooklyn, N. Y.

Robert Surtees, a well-known civil engineer of Canada, died at his home in Ottawa, Sept. 29. He was born at Ravensworth, Yorkshire, England, in 1835, later serving an apprenticeship as civil engineer at Darlington. At the age of 21 he removed to Canada to accept the position of Assistant City Engineer of Hamilton, Ont. Mr. Surtees accepted the position of City Engineer of Ottawa in 1875, and under his direction many of the important civic improvements of that city were carried out. Later he became Engineer of the Improvement Commission.

ENGINEERING SOCIETIES.

COMING MEETINGS.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 9 to 12. Annual Meeting at Birmingham, Ala. Secy., G. W. Tillson, Municipal Bldg., Brooklyn, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.
Oct. 15 to 19. Annual Convention at Columbus, Ohio. Secy., Bernard V. Swenson, 60 Wall St., New York City.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 16. Annual Meeting at Boston, Mass. Secy., S. F. Patterson, Concord, N. H., c/o Boston & Maine R. R.

THE RAILWAY SIGNAL ASSOCIATION.
Oct. 16-18. Annual Meeting at Washington, D. C. Secy., H. S. Balliet, Grand Central Station, New York City.

AMERICAN GAS INSTITUTE.
Oct. 17-19. First Annual Meeting at Chicago, Ill. Acting Secy., James W. Dunbar, New Albany, Ind.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Nov. 13-15. Annual Meeting at Chicago, Ill. Secy., C. E. Jones, Beardstown, Ill.

AMERICAN MINING CONGRESS.
Nov. 13-17. Annual Meeting at Denver, Colo. Secy., J. F. Callbreath, Jr., Denver, Colo.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Dec. 3-4. Annual Meeting at New York City. Secy., W. Everett Parsons, 12 Bridge St., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 4-7. Annual Meeting at New York City. Secy., F. R. Hutton, 12 West 31st St., New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
Dec 27-Jan. 2, '07. Annual Meeting at New York City. Secy., L. O. Howard, Cosmos Club, Washington, D. C.

SCANDINAVIAN ENGINEERS' UNION.—The Union was formed early in June at Dresden, Germany. Scandinavian, that is, Norwegian, Swedish, Danish and Finnish, technical students and practicing engineers of Europe or America are eligible to membership. The Union is under the direction of a central committee, while under this central committee are local committees representing the various branches at the academies and capitals of Scandinavia. It is the intention of the organizers of this union to keep the addresses of all persons eligible to membership, as well as those of members, on file. They also intend to run an employment and industrial department in conjunction with the union for the benefit of its members. Otherwise the objects of the Union are about the same as those of the ordinary technical society.

AMERICAN ELECTROCHEMICAL SOCIETY. — The tenth general meeting was held Monday and Tuesday, Oct. 8 and 9, in Havemeyer Hall, Columbia University, New York City. Among the papers read and discussed were the following: "Formula for the E. M. F. of a Helmholtz Concentration Cell," by Henry S. Carhart; "Visible Migration of Particles Between Electrodes," by Carl Hering; "Small Laboratory Appliances for Electric Fusion and Other Work," by S. S. Sadtler; "Copper Cathodes in Nitric Acid," by J. W. Turrentine; "Electrolytic Deposition of Gold from Bullion," by H. K. Tuttle; "An Aluminum and Magnesium Cell," by G. H. Cole and H. T. Barnes; "Melting Points of Some Cryolite-Alumina Mixtures," by Francis R. Pyne; "Pyrometers, Theoretically and Practically Considered, with Remarks on the Definition of Temperature," by E. F. Roeber; "A Thermo-Electric Pyrometer for General Industrial Applications," by F. F. Schuetz; "The Decker Primary Battery," by F. B. Crocker. Previous to Prof. Crocker's paper Mr. R. S. Whipple, of Cambridge, England, exhibited a number of lantern slides showing English types of pyrometers, and Mr. R. Moldenke described briefly the Le Chatelier pyrometer. Monday afternoon Chas. Baskerville, Ph. D., lectured on the "Use of Ultra-Violet Light in the Laboratory and in Practice," and later the Waterside Station of the New York Edison Co. was inspected. Tuesday afternoon about 25 members visited the American Smelting & Refining Co.'s works at Perth Amboy, N. J., and in the evening a reception was held at the Chemists' Club, 108 West 55th St., New York City.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, October 11, 1906.

CONTENTS

CONSTRUCTION NEWS:
Plans and Specifications on File..... 123
List of Contracts Pending 123
Railways 124
Electric Railways 124
Light and Power Plants 125
Bridges 125
Buildings ..... 1[illegible]
Water Supply and Irrigation..... 127
Sewerage 127
Streets and Roads..... 128
Manufacturing Plants 128
Miscellaneous Contracts 129
U. S. Possessions and Cuba..... 129
Foreign Contracts 129
CIVIL SERVICE EXAMINATIONS..... 129
INDUSTRIAL NOTES 130
PROPOSALS ..... 13[illegible]

CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

The following Plans (P.), Specifications (S.), and Bidding Sheets (B. S.) may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York:

Bids close.	Work.	Place.	On file.	See issue.
Oct.				
*12	Hospital	New York, N. Y.	P. & S.	9-27
*15	Steel wharf sheds, railways	Manila, P. I.	P. & S.	7-19
*16	Dam, etc.	Lascruces, N. Mex.	P. & S.	9- 6
Nov.				
*1	Dam, etc.	Mitchell, Neb.	P., S. & B. S.	10- 4
3	Pumping mchny.	Norfolk, Va.	S.	10-11
*15	Dam, excavation.	N. Yakima, Wash.	P., S. & B. S.	9-27
*15	Canal, dam, tunnels.	N. Yakima, Wash.	P., S. & B. S.	9-27

*Work advertised in Engineering News.

LIST OF CONTRACTS PENDING.

LIGHT, HEAT AND POWER PLANTS.

Bids close.	Work.	Place.	On file.	See issue.
Oct. 11.	Equipment	Washington, D. C.	Sept.	6
Oct. 12.	Steam fittings	Cleveland, Ohio	Oct.	11
Oct. 13.	Power-house	Charleston, S. C.	Oct.	11
Oct. 13.	Lighting	Milwaukee, Wis.	Oct.	11
Oct. 15.	Equipment	Lowellville, Ohio	Oct.	11
Oct. 16.	Apparatus and equipment	Rushville, Ind.	Oct.	4
Oct. 17.	Power-house	Annapolis, Md.	Oct.	11
Oct. 20.	Light plant	Napoleonville, La.	Oct.	11
Oct. 20.	Gas holder, Egg Harbor City, N. J. Advertised, Eng. News, Oct. 4 to 18.		Oct.	4
Oct. 29.	Equipment	Orange, N. J.	Oct.	4
	Advertised, Eng. News, Oct. 11 and 18.			
Nov. 1.	Lighting	Canastota, N. Y.	Oct.	11

BRIDGES.

Oct. 11.	Bridges, etc.	Delphi, Ind.	Sept.	27
Oct. 12.	Bridges	Coshocton, Ohio	Sept.	27
Oct. 12.	Timbers	Cleveland, Ohio	Oct.	11
Oct. 15.	Bridges	Columbia, S. C.	Oct.	11
Oct. 15.	Revolving bridge, etc., Advertised, Eng. News, Sept. 27 and Oct. 4.	Salem, Mass.	Sept.	27
Oct. 15.	Bridge	Woonsocket, R. I.	Oct.	4
	Advertised, Eng. News, Oct. 4 and 11.			
Oct. 15.	Substructure	Bryan, Ohio	Oct.	4
Oct. 16.	Bridge piers, etc., Advertised, Eng. News, Sept. 27 and Oct. 4.	Winnipeg, Man.	Sept.	27
Oct. 16.	Superstructure	Toronto, Ont.	Oct.	11
Oct. 18.	Bridge	New York, N. Y.	Oct.	11
Oct. 19.	Bridge	Reading, Pa.	Oct.	11
	Advertised, Eng. News, Oct. 11.			
Oct. 20.	Bridge	Eaton, Ohio.	Oct.	11
Oct. 20.	Steel superstructure, Winnipeg, Man. Advertised, Eng. News, Sept. 27 to Oct. 18.		Sept.	27
Oct. 22.	Bridges	Martins Ferry, Ohio	Oct.	4
Oct. 22.	Bridges	St. Clairsville, Ohio	Oct.	11
Oct. 22.	Bridge	Hopewell Cape, N. B.	Oct.	11
Oct. 25.	Bridge	Atlanta, Ga.	Sept.	13
Oct. 26.	Bridges	Wauseon, Ohio	Oct.	11
Oct. 29.	Bridges	Toledo, Ohio	Oct.	11
Nov. 6.	Bridge	Peoria, Ill.	Oct.	11
	Advertised, Eng. News, Oct. 11 and 18.			
Nov. 8.	Bridges	Atlanta, Ga.	Oct.	4
Nov. 20.	Bridge	Winnipeg, Man.	Oct.	4
	Advertised, Eng. News, Oct. 4 to 25.			

BUILDINGS.

Oct. 12.	Hospital	New York, N. Y.	Sept.	27
	Advertised, Eng. News, Sept. 27 and Oct. 4.			
Oct. 13.	Schools	Toronto, Ont.	Oct.	11
Oct. 13.	Depot	Rayne, La.	Oct.	11
Oct. 15.	Church	Seebert, W. Va.	Oct.	11
Oct. 15.	Lighting	Canton, Ohio	Oct.	11
Oct. 15.	School buildings	Port Huron, Mich.	Oct.	4
Oct. 15.	Court-house	Nelson, B. C.	Oct.	4
Oct. 15.	Mail lift	Kansas City, Mo.	Oct.	4
	Advertised, Eng. News, Oct. 4 and 11.			
Oct. 15.	Y. M. C. A. building	Savannah, Ga.	Oct.	4
Oct. 15.	Experimental station	Annapolis, Md.	Oct.	4
Oct. 16.	Employees' quarters	Grand Junct'n, Colo.	Sept.	20
Oct. 16.	Plumbing	Charleston, S. C.	Sept.	27
Oct. 17.	Elevator	Fargo, N. Dak.	Oct.	4
Oct. 17.	Plumbing	Indianapolis, Ind.	Oct.	11
Oct. 18.	Dormitory	Athens, Ohio	Oct.	11
Oct. 19.	Engine-house	New York, N. Y.	Oct.	11
Oct. 19.	Quarters	Youngstown, N. Y.	Sept.	27
Oct. 22.	Guard-house	Washington, D. C.	Sept.	27
	Advertised, Eng. News, Sept. 27 to Oct. 18.			
Oct. 22.	Guard-house	Washington, D. C.	Oct.	4
Oct. 22.	School	New York, N. Y.	Oct.	11
Oct. 22.	Wiring	Sherman, Tex.	Oct.	4
	Advertised, Eng. News, Oct. 4 and 11.			
Oct. 23.	Mess hall	Washington, D. C.	Sept.	13
	Advertised, Eng. News, Sept. 13 to Oct. 18.			
Oct. 24.	Hospital	Utica, N. Y.	Oct.	4
	Advertised, Eng. News, Oct. 4 to 18.			
Oct. 24.	Wiring	Utica, N. Y.	Oct.	11
Oct. 30.	Elevator	New York, N. Y.	Oct.	11
	Advertised, Eng. News, Oct. 11 and 18.			
Oct. 31.	School	Cheyenne Agency, S. Dak.	Oct.	11
Oct. 31.	Academy	Waterloo, Que.	Oct.	11
Nov. 1.	Officers' quarters, Fort Dupont, Del. Advertised, Eng. News, Oct. 4 to 18.		Oct.	4
Nov. 8.	Court-house	Bloomington, Ind.	Oct.	11
Nov. 8.	Quarantine buildings	Portland, Me.	Oct.	11
	Advertised, Eng. News, Oct. 11 and 18.			
Nov. 9.	Hardware	Indianapolis, Ind.	Oct.	11
Dec. 20.	Plans and specifications	Shreveport, La.	Oct.	4

WATER SUPPLY AND IRRIGATION.

Oct. 11.	Water-works	Holland Patent, N. Y.	Sept.	27
Oct. 13.	Water-works extension	Caldwell, Idaho.	Sept.	27
Oct. 14.	Pumping engine	Henderson, Ky.	Sept.	20
Oct. 15.	Well, pump	El Paso, Tex.	Sept.	27
Oct. 15.	Steel tank	Fortress Monroe, Va.	Sept.	27
	Advertised, Eng. News, Sept. 27 to Oct. 11.			
Oct. 15.	Engines, etc.	Albany, N. Y.	Oct.	11
Oct. 16.	Laying pipe	Summit, N. J.	Oct.	11
	Advertised, Eng. News, Oct. 11.			
Oct. 18.	Pumping station	Danville, Ind.	Oct.	11
Oct. 23.	Water	Port Royal, S. C.	Oct.	11
Oct. 27.	Water gate	Washington, D. C.	Oct.	11
Oct. 31.	Pipe	Lancaster, Ohio	Oct.	11
Oct. 31.	Water-works	Whiterocks, Utah	Oct.	4

SEWERAGE.

Oct. 12.	Sewers	Lancaster, Ohio	Oct.	4
Oct. 15.	Sewers	Charleston, Ill.	Oct.	4
Oct. 15.	Sewer	Fort Dodge, Iowa	Oct.	4
Oct. 15.	Sewer	Yankton, S. Dak.	Oct.	4
Oct. 15.	Sewers	Albany, N. Y.	Oct.	11
Oct. 16.	Sewers	Niagara Falls, N. Y.	Oct.	11
Oct. 16.	Sewers	New York, N. Y.	Oct.	11
Oct. 17.	Sewers	Rochelle, Ill.	Oct.	11
Oct. 17.	Sewers	Amsterdam, N. Y.	Oct.	11
Oct. 17.	Pipe, Perth Amboy, N. J.		Oct.	11
Oct. 18.	Pumping station	Danville, N. J.	Oct.	11
Oct. 18.	Sewers	New York, N. Y.	Oct.	11
Oct. 18.	Sewers	Washington, D. C.	Sept.	27
	Advertised, Eng. News, Sept. 27 and Oct. 4.			
Nov. 19.	Sewer and outfall, Los Angeles, Cal. Advertised, Eng. News, Oct. 11 and 18.		Oct.	11
Oct. 22.	Sewers and pumping station	Plainfield, N. J.	Oct.	11
	Advertised, Eng. News, Oct. 11.			
Nov. 6.	Sewers	Dawson, Ga.	Oct.	11
Nov. 7.	Filters	Philadelphia, Pa.	Oct.	11
	Advertised, Eng. News, Oct. 11, 18 and Nov. 1.			
Nov. 8.	Pump, Yonkers, N. Y. Advertised, Eng. News, Oct. 11.		Oct.	11
No date.	Sewer, Lorain Ohio		Oct.	4
No date.	Sewers, Amsterdam, N. Y.		Oct.	4

STREETS AND ROADS.

Oct. 11.	Paving, Buffalo, N. Y.		Oct.	11
Oct. 12.	Roads, Cincinnati, Ohio		Sept.	27
Oct. 13.	Gravel roads, Terre Haute, Ind.		Sept.	27
Oct. 13.	Paving, East St. Louis, Ill.		Oct.	11
Oct. 14.	Macadam, Evanston, Ill.		Oct.	11
Oct. 15.	Repairing asphalt, Youngstown, Ohio.		Oct.	11
Oct. 15.	Paving, Montgomery, Ala.		Oct.	11
Oct. 15.	Paving, New York, N. Y.		Oct.	11
Oct. 15.	Paving, Portchester, N. Y.		Oct.	11
Oct. 15.	Grading, Fort Mott, N. J.		Sept.	27
Oct. 16.	Paving, etc., New York, N. Y.		Oct.	11
Oct. 16.	Paving, Greenland, N. H.		Oct.	11
Oct. 16.	Paving, Tipton, Ind.		Oct.	11
Oct. 17.	Paving, etc., Wellsville, N. Y. Advertised, Eng. News, Oct. 4 and 11.		Oct.	4
Oct. 17.	Grading, New York, N. Y.		Oct.	4
Oct. 18.	Paving, Portchester, N. Y.		Oct.	11
Oct. 19.	Sidewalks, Washington, D. C.		Oct.	4
Oct. 20.	Macadam road, Greencastle, Ind.		Sept.	27
Oct. 20.	Grading, Terre Haute, Ind.		Oct.	11
Oct. 31.	Road work, Albany, N. Y. Advertised, Eng. News, Oct. 11 to 25.		Oct.	11
Oct. 31.	Roadway, Grand Rapids, Mich.		Sept.	27
Oct. 31.	Road, Byron, Mich.		Oct.	4
Nov. 1.	Macadam, Highlands, N. J. Advertised, Eng. News, Oct. 4 to 25.		Oct.	4
No date.	Grading, Macon, Ga. Advertised, Eng. News, Oct. 4.		Oct.	4

MISCELLANEOUS CONTRACTS.

Oct. 11.	Dredging, New York, N. Y. Advertised, Eng. News, Sept. 13 to Oct. 4.		Sept.	13
Oct. 11.	Seawalls	Boston, Mass.	Oct.	4
	Advertised, Eng. News, Oct. 4.			
Oct. 12.	Shells, etc.	Washington, D. C.	Oct.	4
Oct. 12.	Wharf, dredging, etc.	Ft. Hunt, Va.	Sept.	20
Oct. 13.	Boilers, heaters, etc.	Norfolk, Va.	Oct.	4
Oct. 15.	Drains	Rio Grande do Sul, Brazil (Forn).	May	31
Oct. 15.	Steel sheds	Rys., Manila, P. I.	July	19
	Advertised, Eng. News, July 19 to Aug. 30.			
Oct. 15.	Ry. work	Missouri & N. Arkansas Ry.	Sept.	27
	Advertised, Eng. News, Sept. 27.			
Oct. 16.	Dam, canal, excav.	Lascruces, N. Mex.	Sept.	6
	Advertised, Eng. News, Sept. 6 to Oct. 11.			
Oct. 16.	Earth spreaders, etc.	Panama	Oct.	4
Oct. 16.	Naval supplies	Washington, D. C.	Oct.	4
Oct. 16.	Wharf repairs	New York, N. Y.	Oct.	11
Oct. 17.	Subway	Reading, Pa.	Oct.	11
	Advertised, Eng. News, Oct. 11.			
Oct. 18.	Fire alarm system	Petersboro, Ont.	Oct.	4
Oct. 19.	Cement	New York, N. Y.	Oct.	11
Oct. 19.	Rubber fire hose	New York, N. Y.	Oct.	11
Oct. 20.	Embankment	East St. Louis, Ill.	Oct.	11
Oct. 20.	Breakwater	Goderich, Ont.	Oct.	11
Oct. 20.	Crematories	Salem, N. J. Advertised, Eng. News, Sept. 27 and Oct. 4.	Sept.	27
Oct. 22.	Pier	Norfolk, Va.	Oct.	4
	Advertised, Eng. News, Oct. 4 to 18.			
Oct. 22.	Dredging plant	Detroit, Mich.	Oct.	11
	Advertised, Eng. News, Oct. 4 to 18.			
Oct. 23.	Naval supplies	Washington, D. C.	Oct.	4
Oct. 23.	Tunnel entrance	Boston, Mass.	Oct.	11
Oct. 24.	Railway work	Belgium (Foreign)	Oct.	11
Oct. 25.	Moorings	Tompkinsville, N. Y.	Oct.	11
Oct. 27.	Revetment wall	Owen Sound, Ont.	Oct.	11
Oct. 29.	Conduit, embankment	Boston, Mass.	Oct.	11
	Advertised, Eng. News, Oct. 11 and 18.			
Oct. 29.	Crematory	Delaware City, Del.	Oct.	4
	Advertised, Eng. News, Oct. 4 to 18.			
Oct. 30.	Naval supplies	Washington, D. C.	Oct.	4
Nov. 1.	Dam, etc.	Mitchell, Neb.	Oct.	11
	Advertised, Eng. News, Oct. 4 to 25.			
Nov. 6.	Subway substructure	Toronto, Ont.	Oct.	4
	Advertised, Eng. News, Oct. 4 and 11.			
Nov. 6.	Railway	Spain (Foreign)	Aug.	30
Nov. 8.	Canal work	Albany, N. Y.	Oct.	11
	Advertised, Eng. News, Oct. 11 to Nov. 1.			
Nov. 9.	Canal work	Albany, N. Y.	Oct.	11
	Advertised, Eng. News, Oct. 11 to Nov. 1.			
Nov. 13.	Cranes	Washington, D. C.	Oct.	11
Nov. 15.	Canal, dam, tunnels	N. Yakima, Wash.	Sept.	27
	Advertised, Eng. News, Sept. 27 to Nov. 1.			
Nov. 15.	Dam, excavation	N. Yakima, Wash.	Sept.	27
	Advertised, Eng. News, Sept. 27 to Nov. 1.			
Dec. 1.	Garbage reduction	Spain (Foreign)	Oct.	11
	Advertised Eng. News, Oct. 4 and 11.			
Mar. 18. ('07).	Tunnel	New Zealand (Foreign).	Sept.	13
	Advertised, Eng. News, Sept. 13 to Mar. 14.			
No date.	Jetty plans, estimates, Asbury, N. J. Advertised, Eng. News, Sept. 27.		Sept.	27
No date.	Grading, Macon, Ga. Advertised, Eng. News, Oct. 4.		Oct.	4
No date.	21 miles grading, Natchez & Eastern Ry. Advertised, Eng. News, Oct. 11 and 18.		Oct.	11

CIVIL SERVICE EXAMINATIONS.

Oct. 11.	Inspector Sewer Const.	New York, N. Y.	Sept.	27
Oct. 17.	Bridge Engr.	Manila, P. I.	Sept.	27
Oct. 17.	Prin. Asst. Ch. Engr.	Manila, P. I.	Sept.	27
Oct. 17.	Asst. Engr.	Manila, P. I.	Sept.	27
Oct. 17.	Junior C. E.	Manila, P. I.	Sept.	27
Oct. 17.	Master Builder	Manila, P. I.	Sept.	27
Oct. 17.	Second Asst. Engr.	Manila, P. I.	Sept.	27
Oct. 17.	Scientific Asst.	Washington, D. C.	Sept.	20
Oct. 17.	Engineer	Oklahoma	Oct.	11
Oct. 24.	Engr. and Carpenter	Nebraska	Oct.	11
Oct. 30.	Topographic Draftsman	Wash., D. C.	Oct.	11
Oct. 30.	Cartographic Draftsman	Wash., D. C.	Oct.	11
Oct. 30.	Clerk Draftsman	Washington, D. C.	Oct.	11
Oct. 30.	C. E. & Supt. Construction	Wash., D. C.	Oct.	18
Oct. 31.	Chief, Water Bureau, Philadelphia, Pa. Advertised, Eng. News, Oct. 11.		Oct.	11
Nov. 7.	Topographic Draftsman	Panama	Oct.	18

REGARDING NEW PROJECTS

ENGINEERING NEWS desires to obtain the **earliest possible reliable information** concerning all projected work. We will appreciate any items that you may send us. Copies containing such information will be mailed to you, upon request.

ADDRESS THE

Construction News Department

RAILWAYS.

The names of parties awarded contracts are printed in capital letters.

ASHLAND & WESTERN.—Incorporated in Ohio, with $200,000 capital, by Z. W. Davis, Isaac H. Taylor, William Simpson, W. L. Stolzenbach and H. B. Stewart, to build a steam railroad across the state from Vermillion, on the Lake Shore & Michigan Southern and the New York, Chicago & St. Louis, south through Erie, Lorain, Ashland, Wayne, Holmes, Coshocton, Muskingum, Noble, Morgan and Washington Counties, to the Ohio River at Marietta, on the Baltimore & Ohio and the Pennsylvania, about 175 miles. The office of the company is at Ashland, Ohio.

ATLANTIC & WESTERN.—Company has been chartered in Georgia to build a line 65 miles long, from Fleming, Ga., on the Atlantic Coast Line, through Homerville, Smiley and Glennville to Vidalia. Capital, $2,000,000. The incorporators are W. C. Long, E. C. Miller, J. R. Pryor, A. L. Kinston, J. C. Hines, John Kirkland, C. U. Hendry, R. Lloyd Henry, W. W. Frazier, A. B. Brewer, T. S. Layton, S. B. Brewton, N. J. Norman, H. S. Long and Donald Fraser, of Liberty County, and S. F. Smith, D. J. Padgett, J. S. Easterling, G. J. Sweeney, W. L. Rogers and J. J. Barrow, of Tatnall County.

CHICAGO & NORTHWESTERN.—Official announcement regarding construction of new lines is made for the year ending June 30, 1907: The Wyoming & Northwestern Ry. has been nearly completed and will be opened for traffic during the ensuing month from Casper, Wyo., to Shoshoni, a new town located near the eastern boundary line of the Shoshoni Indian Reservation in Wyoming, a distance of 102.4 miles. From Shoshoni to the proposed terminus at Lander, Wyo., a distance of 45.7 miles, the construction of the railway is well advanced and will be completed during the year 1906. The Manitowoc, Green Bay & Northwestern Ry. has been completed from Manitowoc, Wis., to the east side of the Fox River, near Green Bay, a distance of 34.74 miles. The bridge over the Fox River, near Green Bay, and the remaining sections of the railway extending from Duck Creek to Gillett, Wis., a distance of 29.88 miles, and from Pulaski to Eland Junction, Wis., a distance of 48.38 miles, are under construction and will be completed during the ensuing autumn. The Milwaukee & State Line Ry., extending from an intersection with the present third and fourth main tracks of the Milwaukee line, near Lake Bluff, Ill., to an intersection with the third and fourth main tracks of that line, near St. Francis, Wis., a distance of 50.34 miles, is nearing completion, and, it is expected, will be opened for traffic during October. This is a double-track railway and will provide the company with a continuous four-track system between the cities of Chicago and Milwaukee. The branch railways extending from near Kaona on the Ashland division, in Wisconsin, to an intersection with the Peninsula division at Saunders, Mich., a distance of 29.51 miles, and from Mercer, Wis., to the Presque Isle District, a distance of 19.49 miles, have been completed and opened for traffic. The Pierre & Fort Pierre Bridge Ry. will extend from an intersection with the Dakota Division of the Chicago & Northwestern, in the city of Pierre, S. Dak., to an intersection with the Pierre Rapid City & Northwestern Ry., 0.2 miles north of Fort Pierre, a distance of 1.49 miles. The crossing of the Missouri River will be effected by the construction of a bridge between Pierre and Fort Pierre. The substructure of this bridge will consist of seven masonry piers carrying the superstructure and one up-stream protection masonry pier for the draw span. The superstructure will consist of four fixed spans, each 350 ft. long, and a draw span 445 ft. long, its total length from center to center of end piers being 1,864 ft. The draw span provides for two clear openings, each 200 ft. wide. The Pierre, Rapid City & Northwestern Ry. begins at an intersection with the Pierre & Fort Pierre Bridge Ry., 0.2 miles north of Fort Pierre, and extends in a general westerly direction, traversing portions of Stanley, Lyman and Pennington Counties, and terminates at an intersection with the Nebraska & Wyoming division of the Chicago & Northwestern at Rapid City, a distance of 165.47 miles. The construction of this railway is well advanced and will be completed in the early part of 1907. The company has also undertaken the construction of an extension from Bonesteel, S. Dak. to Gregory, S. Dak., a distance of 25.93 miles, which will be completed during the ensuing fiscal year. An ordinance has been passed by the City Council of Sheboygan, Wis., which will permit the construction of a cut-off 4.13 miles long through that city in connection with a new passenger station and a new freight house. In addition to effecting a saving in distance the cut-off will avoid the heavy grades and numerous grade crossings on the present line. E. C. Carter, Gen. Engr., Chicago.

CHICAGO, ROCK ISLAND & GULF.—Company has amended its charter providing for the construction of a branch line from Irving, Dallas County, Tex., north to Carrollton, a distance of twelve miles. Surveys have been completed for this line and construction will begin at once. S. B. Hovey is Gen. Supt. and J. S. Peter Chief Engr., at Fort Worth, Tex.

CORTLAND & AUBURN.—We are officially advised that this company, recently incorporated in New York, probably will let contracts soon for building its railway from Cortland to Auburn in a direct line, about 36 miles in length. Survey has been made and nearly all right-of-way secured. Benjamin L. Webb is Pres., Cortland, N. Y. Walter Loring Webb, 2222 Land Title Bldg., Philadelphia, is Ch. Engr. Work to be done is principally gravel with about four miles of difficult work. This company was erroneously noted last week under title of "Portland & Auburn." N. A. Bundy is Vice-Pres. and Gen. Mgr., at Cortland.

GEORGIA & EASTERN.—This company has been granted a charter in Georgia to build a railroad from Americus via Vienna to Eastman, 82 miles, passing through the counties of Sumter, Dooly, Wilcox, Pulaski and Dodge. Capital stock, $100,000. Incorporators: J. P. Heard, J. O. Hamilton, Joseph Burns, P. G. McDonald, M. P. Hall, J. J. Cooper, C. T. Stovall, Ed. Howell, D. B. Thompson and J. Frank Howell. Headquarters, Vienne, Ga.

GULF & SABINE RIVER.—This company has been organized at Leesville, La., to build a railroad from Leesville to Merryville, La. Capital stock, $100,000. Directors: S. H. Fullerton, M. L. Fleihel, C. S. Millard, J. L. Reaves and G. W. Johnson. Headquarters, Leesville, La.

LOUISVILLE & NASHVILLE.—This company has authorized the construction of 26 miles of double track between Corbin and Livingston, Ky. It is reported to have awarded to the EDINGTON-GRIFFITHS CONSTRUCTION CO., of Knoxville, a contract for 14 miles of the work. The contractors will do the heavy work requiring steam shovels, and will sublet the remainder.

MOBILE & WESTERN.—Incorporated in Alabama with $100,000 capital to build a line from Mobile west to the Mississippi River. R. K. Mann, of Muskegon, Mich., is Pres.; G. Watwood, of Mobile, Vice-Pres. and Gen. Mgr., and W. H. Mann, of Elkhart, Ind., Secy. and Treas. H. A. FILKENS, of Mobile, has contract for work under way. Grading has been completed for 15 miles, and track laid for ten miles.

NATCHEZ & EASTERN.—Bids are asked by this company at office of Chief Engineer, Brookhaven, Miss., for grading 21 miles of roadbed in Franklin County, between the Homochitto River and Wells Creek, near Roxie. (Advertised, Engineering News.)

NORTH SHORE & WESTERN.—Incorporated in Illinois to build a railroad from Evanston to Elgin. Capital stock, $50,000. Incorporators: William C. McHenry, Harry P. Pearsons, William A. Love, Ernest R. Fifer and George P. Merrick. Principal office, Chicago.

OCONEE COUNTY RY.—C. G. Sayre, Anderson, S. C., Ch. Engr., advises us that contracts for construction probably will be let next spring. The company proposes to build a 15-mile railway from Westminster to Townville, S. C., via Oakway Cross Roads. Surveys have been made and right-of-way secured. Capital is nearly all obtained. J. J. Fretwell is Pres.

PORT ANGELES & PENINSULAR.—Lester Turner, Pres., Seattle, Wash., advises us that this railway has been sold to the Northern Pacific R. R. Co. As previously noted, "financial arrangements are said to have been made for building this road from Port Ludlow, Wash., to the Quillayute River. From Port Angeles the main line will be built with all possible speed to Lake Crescent, 20 miles west, and thence five miles along the shore of the lake. Simultaneously construction will be carried eastward 50 miles to Port Ludlow. It is expected that before 1907 these 75 miles will be in operation, and connected with Seattle and Everett by means of ferries. The sea distances are approximately 26 miles from Port Ludlow to Everett, and 35 miles from Port Ludlow to Seattle. Huge ferries of the type of the boats now carrying trains across the bay at San Francisco will be used for the immense lumber tonnage to be developed, while a fast, commodious boat will take care of the passenger traffic across the sound. From Lake Crescent the western division of the Port Angeles & Peninsular will be extended 53 miles to the Quillayute River. From Junction City on the Port Ludlow line the Port Angeles & Olympia will build 97 miles south to the state capital. The total mileage of the semi-circular line around the Olympics will be 211; 133 miles from Olympia to Port Angeles and 78 miles from Port Angeles to Quillayute. To feed this main line from the timber tonnage to be drawn upon several laterals are to be run toward the heart of the Olympics." Lester Turner, of Seattle, Wash., is Pres. A press report recently stated that "Port Angeles is to be made the milling center of the system. To a plant now having a daily output of 750,000 shingles are to be added immediately the mills of three new companies, which promise a daily output of 250,000, 500,000 and 500,000 feet, respectively. This much as a beginning at an early day for what is intended to become the greatest lumber milling center in the state, perhaps in the world."

RIVERSIDE, R. R.—This company has been organized at Reno, Nev., with a capital stock of $1,000,000 to build a line from Reno north to Laughton Springs, six miles. Among the incorporators are F. R. Nicholas, Peter Dohr and W. H. Pennell.

ROUND POND TERMINAL CO.—This company has been incorporated in Arkansas with a capital stock of $5,000 to build a line at Forest City, Ark., from Round Pond to connect with other roads. G. V. Nash and F. W. Perkin, of Forest City, are named as the incorporators.

ST. LOUIS & MONTESANO.—Incorporated in Missouri to build a railroad from the St. Louis County line to Flat River, 63 miles. Capital stock, $4,000,000. Incorporators: Charles A. Gutke, A. Furer, L. A. Hall, Harry W. Gutke and B. Wasserman, all of St. Louis, Mo.

SHELBY COUNTY RY.—We are officially advised that this company is ready to let contracts for building its line from Shelbina to Shelbyville and Bethel, Mo., 14 miles. William C. Blackburn is Pres., at Shelbina, Mo. William Mitchell is Ch. Engr., Shelbyville, Mo. Survey has been made. Company has everything ready to begin work and will receive bids.

SIERRA PACIFIC.—Company has been organized in California by Otto E. Bashore and Josiah W. Davis, of Porterville, Cal.; R. Linder, of Tulare; T. A. Howeth, of Porterville; Frederick Ackerman, of Plano; Frederick A. Dodge, of Hanford; C. B. Reas, of Success; L. E. McCabe, of Visalia; George D. Avery, of Porterville; S. E. Henley, of Globe, and James H. Stuffebeem, of Kern City. The directors organized by electing Otto E. Bashore, Pres.; Josiah W. Davis, First Vice-Pres.; C. B. Reas, Second Vice-Pres.; T. A. Howeth, Secy., and R. Linder, Treas. L. E. McCabe, of Visalia, was appointed Ch. Engr. Several committees on right-of-way, finance, supplies, surveys, etc., were named by the president. The capital stock, as stated in the articles of incorporation, is $5,000,000. The road will begin at Globe, as the eastern terminus, and run westward through Success, Worth, Piano, Porterville, Woodville and Tulare, thence north through Tagus, thence west to Hanford. From Hanford west through Lemoor, Huron, Coalinga, to a point northwest of Alcalde, where the road will pass through the mountains. From this point it will run in a southerly direction to Paso Robles and through Templeton and Santa Margarita to San Luis Obispo and Port Harford, where the western terminus will be located. Also commencing at a point near Tulare, a road will be constructed to the northward, through Visalia to Fresno, possibly passing through Dinuba, Reedley or Orosi and probably through Sanger, from the same point southward to Bakersfield.

SOUTH CAROLINA.—T. W. Law, of Bishopville, S. C., announces that survey has been completed for a railroad to connect Bishopville with the Seaboard Air Line, and company expects to commence construction by Jan. 1. The road will be about 22 miles long. Company already owns or has secured by option terminal sites and right-of-way. Mr. Law wishes to correspond with dealers in railway supplies, rails, ties, etc. A survey for an extension is being made to Lancaster, S. C. Bonds will be issued, and Mr. Law will be glad to get in touch with parties handling such securities.

TEXAS.—Mayor R. L. Chalk, of Killeen, Tex., advises us that parties interested are now negotiating with capitalists to build a railway from Fort Worth to Georgetown and Aransas Pass, and also to Godley, Glen Rose, Hico, Hamilton, Yatesville, Killeen, Florence and other towns, about 400 miles long. Towns along proposed route will donate right-of-way, depot grounds, etc. No survey has been made.

THOMASVILLE & NORTHEASTERN.—This company has been granted a charter in Georgia to build a railroad from Thomasville to Sparks, 50 miles. Capital stock, $50,000. Incorporators: J. Frank Harris, W. L. Adams, H. Roberts and C. C. Shelley, of Pavo; J. J. Hodges, of Okalico; Berry Croft, of Hemstead; E. M. Smith, J. F. Evans, C. W. Cooper, W. C. Snodgrass, of Thomasville. Principal office, Thomasville, Ga.

WESTERN & GULF.—This company has applied for a charter in Georgia to build a railroad from Americus to Hawkinsville, 85 miles; capital stock, $200,000. Incorporators: Frank Lanier, Lee Allen, E. C. Parker, C. C. Hawkins, Crawford Wheatley, Frank Sheffield, G. M. Eldridge, W. S. Roach, J. E. Sheppard, H. L. Mize, C. L. Ansley, R. J. Perry, J. J. Hanesley, W. M. Jones, George Oliver, M. B. Council, S. A. Pruitt, R. S. Broadhurst, D. M. Borum, J. S. Bolton, A. W. Smith, A. Rylander and J. C. Roney, of Americus and Sumter County, and J. Pope Brown, P. H. Lovejoy, J. F. Coney, W. N. Parsons, D. Rhodes, J. L. Huggins, J. H. Taylor, T. B. Ragan, T. C. Taylor, W. C. Hurley, E. J. Henry and J. J. Harvard, of Hawkinsville and Pulaski County. Headquarters, Americus, Ga.

ELECTRIC RAILWAYS.

The names of parties awarded contracts are printed in capital letters.

SPRINGVALE, ME.—The York & Oxford Ry. Co. has been incorporated in Maine to build a standard-gage railway from terminus of the Atlantic Shore Line Ry. in Springvale through the towns of Sanford, Shapleigh, Acton, Newfield, Limerick, Parsonsfield, and Cornish in York County, Porter and Hiram in Oxford County, and from Baldwin to Bridgeton Junction in Cumberland County, a total of 40 miles. The capitalization is $160,000. The directors are Fred. J. Allen, Secy. of the Atlantic Shore Line Ry., George W. Hanson, Sanford; J. M. Lord, Parsonsfield; Henry E. Eastman, Charles G. Moulton, Limerick; Ira H. Moore, A. P. Towle, Newfield; Allen Garner and O. L. Stanley, Kezar Falls.

BOSTON, MASS.—Application has been made to the Board of Railroad Commissioners for a certificate to show that a public exigency exists for the construction of the proposed Boston & New York Electric R. R., by A. B. Leach and James G. Campbell, of South Orange, N. J.; of William O. Blaney, of Boston; Elwyn G. Preston, of Woburn, Mass.; S. W. Reynolds and Harry M. Howard, of Brookline; Edward C. Sherburne, of Boston; James M. W. Hall, of Cambridge; of Theodore N. Vail, of Lyndonville, Vt. Announcement of the plan to build a line between the cities named in the title of the company was made in Boston last week by S. D. Reynolds, 35 Congress St., Boston, who estimates the cost of the road and its equipment at about $20,000,000. It is stated that there will be no difficulty whatever in securing the necessary funds.

SYRACUSE, N. Y.—We are officially informed that contract has been let to C. E. & J. S. KAULBACK, of Phoenix, N. Y., for building a 15-mile extension for the Syracuse, Lake Shore & Northern R. R. from Baldwinsville to Fulton, N. Y. Thomas H. Mather is Ch. Engr., at Syracuse.

WESTPORT, N. Y.—The Essex County Traction Co. has been incorporated with a capital of $1,500,000, to construct an electric road 41 miles long, from Westport on Lake Champlain to Newman, Essex County, running through Elizabethtown. The principal office is at Au Sable Forks. The directors are: Albert L. Washburn, Norman C. Spencer, Wilbur T. Holliday and E. S. Goodrich, of Hartford, Conn.; William L. Miley and Thomas D. Trumbull, of Glens Falls, and R. L. Trumbull, of Au Sable Forks.

HARRISBURG, PA.—Charters have been issued at the State Department to the Midway & Burgettstown Street Railway Co., capital $37,000, to build a 6½-mile line between Midway and Burgettstown. The directors are: Chas. V. Dahlinger, Pittsburg, Pres.; John W. Thomas, V. A. Powell, J. B. Flack, L. W. Bingham.

The Governor has approved the application of the Douglass & Donora and West Newton & Webster Street Railway Companies for a merger under the name of the Pittsburg, McKeesport & Westmoreland Railway Co., with a capital of $48,000, and offices in Pittsburg. The officers are: T. F. Barrett, Pittsburg, Pres.; I. I. Robertson, West Newton, Vice-Pres.; J. E. Hornberger, Pittsburg, Secy., and E. P. Douglas, West Newton, Treas.

PENNSBORO, W. VA.—The Kanauga Traction Co., of Pennsboro, has been chartered to build a line from Gallipolis to Pomeroy, with principal office at Pennsboro and a branch at Kanauga, Ohio. Work probably will begin immediately. The incorporators are: H. March, J. H. Lininger, of Harrisville; A. M. Douglas, of Cairo; C. R. Cunningham, M. K. Duty, of Pennsboro, W. Va.

ATLANTA, GA.—We are officially advised that the Atlanta, Buford & Gainesville Electric Ry. Co. has made a survey for its proposed line, which is to run from Atlanta to Norcross and Gainesville, with a branch from Norcross to Cumming, 80 miles. Right-of-way is practically all secured. E. Philbrick is Ch. Engr., at Baldwin, Ga.

MEMPHIS, TENN.—We are officially informed that the Memphis, Covington & Northern Ry. Co. will build a 39-mile electric railway from Memphis to Covington, Ky. Surveys are made, but right-of-way is not yet secured. Maps, profiles and estimates are being prepared. The W. K. Palmer Co., Dwight Bldg., Kansas City, Mo., is Engr.

CORINTH, MISS.—Mark T. Bynum states that the Corinth & Shiloh Electric Railway Co. has been financed by W. W. Williams & Co., of Nashville, Tenn., who took the entire bond issue of $500,000. Construction of the proposed line from Corinth to the National Shiloh Park, Shiloh, Tenn., 22 miles, will begin soon. Abe Rubel, of Corinth, is Pres. Noted last week.

CLEVELAND, OHIO.—At a recent meeting of the directors of the Cleveland & Southwestern Traction Company a committee was appointed to go over the plans for improvements to the system, and to decide whether to carry out all of the plans immediately and spend $75,000 or to spend only $50,000 for the present. The company is now securing estimates on the cost of installing an additional turbine and boilers in its Elyria power station, to take care of the needs of the Cleveland, Ashland & Mansfield extension to the system, which is now well under way.

MARION, OHIO.—John G. Webb, George H. Holzbog H. B. Harris, James S. Webb and George Whysall have incorporated the Marion & Western Railway, Light & Power Co., of Columbus, with an authorized capital stock of $200,000. The new company is controlled by the same interests which own the Columbus, Delaware & Marion, to Richwood, Marion County. The distance is a little more than seven miles. With the completion of the line, work on which will begin soon, through cars will be run from Richmond to Columbus. John G. Webb, James A. Webb and Messrs. Holzbog, Harris and Whysall also have incorporated the Marion & Suburban Railway Co., of Columbus, with a capital stock of $250,000. This company will operate street railways in Marion and lines extending from Marion to other towns in Marion County.

TOLEDO, OHIO.—The Riggs & Sherman Co., Consult. Engrs., the Nasby Bldg., Toledo, will prepare plans for a traction line to connect Toledo and Defiance.

WABASH, IND.—V. J. Drayer, Pres. of the Indiana Central Traction Co., announces that the road has been financed and that the construction of the line from Wabash to Warsaw will commence at once.

LAFAYETTE, IND.—Arrangements have been made whereby 13 miles of electric railway, a part of the system planned by the company incorporated to construct a traction road from this city to Chicago, will be built by the students of Purdue University. The officers of the company and the faculty of the university have made arrangements whereby the students will have full charge of the work of building the first section of the road, and they have already begun the survey under the guidance of the members of the faculty.

EFFINGHAM, ILL.—The Effingham & Olney Interurban R. R. Co. plans to build an electric railway to connect Effingham, Olney, Elliottstown, Eberle, Bible Grove, Ingraham and Passport. The company is desirous of financing the project and would be pleased to hear from companies which might be willing to finance the road. Dr. R. S. Wishard, Eberle, Ill., represents the company.

ST. LOUIS, MO.—The Jefferson Traction Railway Co. was incorporated Oct. 1. It holds franchises for and is preparing to build about 20 miles of road connecting six cities and towns near St. Louis. Electric power probably will be used. E. R. Kinsey, 313 Real Estate Bldg., St. Louis, is Gen. Mgr., and Eng.-in-Charge.

CLEBURNE, TEX.—M. D. Miller and C. C. Byers announce that preparations are about completed and they are about ready to take up correspondence about building the proposed interurban railway from Cleburne to Glen Rose, of which they are the promoters. Address Lock Box 595, Cleburne, Tex. Noted on Aug. 30.

DALLAS, TEX.—The charter of the Texas Traction Co. has been filed with the Secretary of State providing for the construction of a line of electric interurban railway from Sherman to Dallas, Tex., a distance of about 65 miles. Construction will begin at once. The company has authority to own and operate street car lines in the cities it passes through, also union passenger depots. The

capital stock of the company is $3.000.000. The following are its directors: F. H. Proctor, Boston, Mass.; W. G. Clark, New York; W. R. Brentz, Sherman, Tex.; J. S. Head, McKinney, Tex.; R. H. Baker, Austin, Tex.; D. A. Templeton and O. Goodwin, Dallas, Tex.; W. J. Neale, Ft. Worth, Tex.; M. B. Templeton, Waxahachie, Tex.; F. A. Jones, Houston, Tex., and J. N. Simpson, Dallas. The main office of the company will be at Dallas. Noted on Sept. 20.

FORT WORTH, TEX.—The Citizens' Railway & Light Co. of North Fort Worth and Arlington Heights, is a new company recently incorporated to take over the Arlington Heights Traction Co. of six miles, and the North Fort Worth & Rosen Heights line of twelve miles; also the Citizens' Light & Power plant. The company intends building an interurban railway from Fort Worth to Mineral Wells. The directors are: Warren Bicknell, of Cleveland, Ohio; J. R. Harper, E. W. Christy and Carey B. Close, of Toledo, Ohio; W. O. Allen, of Fostoria, Ohio; Sam Rosen, George E. White and George E. Montgomery, of Fort Worth. Noted on Sept. 16.

LAWTON, OKLA.—The Lawton Rapid Transit Railway Co. has been chartered, capital $1,000,000, to build 20 miles of electric railway in Lawton. The incorporators are: Neal S. Doran and E. H. Shaufler, of Kansas City; W. M. Smith, H. A. Lloyd and J. Elmer Thomas, of Lawton.

The Lawton Interurban & Street Railway Co. has been chartered with $100,000 capital to build an interurban electric railway from Lawton to Fort Sill and other points in Comanche County. The incorporators are: Frank Broadwell, Frank McMasters, Phil McGrory, B. F. Bowman and George Short.

STERRETT, IND. T.—A. S. Farnham, Atoka, Ind. T., in reference to the Oklahoma Heat, Light & Traction Co.'s railway, advises us, under date of Oct. 1, that "no definite steps have been taken yet toward organizing this company. I am the local counsel for the people who are interested in the proposition, and about all that has been done is to look over the field and see what inducements can be secured. The proposed name and route are given on the enclosed card, and that is about all the definite information that I can now furnish you. I expect to file the articles of incorporation in a few days, and the survey will probably commence in less than two weeks. I. T. Murray, Sterrett, Ind. T., is giving the matter his personal attention, and all communications relative to the matter should be addressed to him. The line will extend from Sterrett to Marietta, Sulphur and Kemp, about 150 miles. Capital is secured. Contracts will be let in about 90 days. Motive power will be electricity or gasoline."

TACOMA, WASH.—The Tacoma Railway & Power Co. and the Puget Sound Electric Co. will build an interurban railway connecting Tacoma, Puyallup, Sumner and Orting as soon as the franchises can be secured. The line between Puyallup and Sumner will be built first, and will be connected with the present Puyallup-Tacoma line until the line running out of the valley from the end of Puyallup Ave. can be constructed. Stone & Webster, Boston, Mass., are Engrs. W. S. Dimmock, Tacoma, is Mgr.

NAPA, CAL.—GEORGE ERRINGTON, of Napa, has secured the contract for the grading the 18-mile extension of the Napa Valley Electric Railroad from Napa to St. Helena. The route of the new road will pass through a private right-of-way from Napa to Union Station, Yountville, Oak Knoll and Rutherford, and will have its present terminus at St. Helena, although it is understood that the contracts for the Calistoga extension will be let in the near future if the labor and material market assume a more hopeful aspect. L. J. Perry is Mgr.

LIGHT AND POWER PLANTS.

The names of parties awarded contracts are printed in capital letters.

MANCHESTER, VT.—It is reported that the city will erect a lighting plant at a cost of $30,000.

BRIDGEPORT, CONN.—It is reported that the Connecticut Ry. & Lighting Co. is to erect a power plant on the Housatonic River below Bulls Bridge. J. E. Sewell is Gen. Mgr. Estimated cost, $700,000.

CANASTOTA, N. Y.—Bids are asked until Nov. 1 by E. B. Roberts, Village Clk., for lighting the streets and public square of this village for a period of two or five years, beginning Feb. 6, 1907.

NEW YORK, N. Y.—The ELECTRIC POWER & EQUIPMENT CO. has been awarded the contract for installing the electric equipment in School 90, Borough of Manhattan, for $14,930.

PITTSFIELD, N. Y.—The Pittsfield Electric Co. has increased its bond issue from $100,000 to $150,000, and the capital stock has been increased from $150,000 to $225,000.

ORISKANY, N. Y.—It is reported that a municipal plant is to be erected here to light the city by electricity.

ORANGE, N. J.—Bids are asked by the Street Lighting Committee until 8 p. m., Oct. 29, for engines, generators and arc lights in connection with the municipal lighting plant. Edward Cheetham is Chn. (Advertised, Engineering News.)

RIVERSIDE, N. J.—The William Steele & Sons Co. have plans posted for a power-house to be erected here. The buildings will be two stories high, of brick and structural iron, and will cover an area 81 × 70.6 ft.

ANNAPOLIS, MD.—Bids are asked by the Navy Department, Washington, D. C., until noon, Oct. 17, for the erection of a reinforced concrete power house at the U. S. Naval Academy. Truman H. Newberry, Acting Secy.

BALTIMORE, MD.—The Washington, Baltimore & Annapolis Railway Co., Maryland Trust Bldg., Calvert and German Sts., which is building an electric line between Baltimore, Washington and Annapolis, will erect three power stations, one to be located near Academy Junction and the other ones near Baltimore and Washington. Contracts for power equipment have been awarded. George T. Bishop is Pres.

DANVILLE, VA.—It is reported that the city will spend $40,000 in improvements on the gas plant. Frank T. Albott is Supt. of Gas Works.

LURAY, VA.—At a recent meeting of the stockholders of the Shenandoah River Light & Power Co., which is developing the water power of the Shenandoah River, $10,500 additional stock was subscribed to complete the construction work on the plant. The company has a capital stock of $62,000. The cost of the plant will be from $55,000 to $60,000, including the amount paid for the gas plant and Luray Electric Co.'s plant. It is expected to have the plant in operation by Dec. 1. It is estimated that about 600 HP. will be transmitted by electricity to Luray. John L. Livers is Ch. Engr.

LYNCHBURG, VA.—H. L. Shaner, City Engr. of Lynchburg, writes that this city will shortly advertise for bids for the construction of an arc lighting plant. Lamar Lyndon, of New York, is Consult. Engr. for this work.

HICKORY, N. C.—The Water-Power Electric Co. is planning to begin the construction work required for the establishment of its proposed water-power electric plant. It is proposed to utilize water powers on the Catawba River and develop 12,500 HP. for transmission by electricity to Hickory and to industries in this section. The initial installation will be planned for 8,000 HP., and engineers have recently been making surveys and estimates. Probably plans and specifications for constructing dam, building electric power-house and installing machinery will be ordered in the near future, and further details as to the entire project will soon be announced. It is understood that B. F. Groff, of Lancaster, Pa., Wallace Wilson, of Tyrone, Pa., and other Pennsylvania parties will be interested. Marcellus E. Thornton is Pres.

CHARLESTON, S. C.—Bids are asked until 11 a. m., Oct. 13, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for a power plant. Mordecai T. Endicott, Co. of Bureau.

BRANDON, MISS.—Kirkpatrick & Johnson, Archs., of Jackson, are making preliminary plans for water-works and electric light plant, which is to be erected here at a cost of about $25,000. R. E. Galden is Mayor.

NAPOLEONVILLE, LA.—Bids are asked until Oct. 20 by Philip H. Gilbert, Mayor, for constructing an electric light plant. H. B. Barringer, of Cinclare, La., is Consult. Engr.

WATERTOWN, TENN.—The electric light plant to be erected here by the Watertown Light & Power Co. is to cost about $15,000. Noted in issue of Sept. 20.

ATHENS, OHIO.—See under Buildings.

CLEVELAND, OHIO.—Bids are asked by the Board of Public Service until Oct. 12 for steam fittings and connections for the municipal electric light plant. J. B. Vining is Secy.

LOWELLVILLE, OHIO.—Bids are asked until Oct. 15 by the Board of Trustees of the Lowellville Electric Light Works for furnishing material and installing an electric light plant, comprising boiler, engine, dynamo and switchboard.

MINERVA, OHIO.—It is reported that an electric light plant is to be erected here.

WESTERVILLE, OHIO.—The citizens have voted to issue $12,000 of bonds for a municipal lighting plant and the purchase of the plant of the Westerville Electric Co. The plant will, it is said, be run in connection with the water-works system, and will be enlarged and improved.

ANN ARBOR, MICH.—The Washtenaw Power & Light Co. is expected to begin work on a power dam on the Huron River near here next spring. The company is backed by the North American Power & Development Co.

CHILLICOTHE, ILL.—The Water, Light & Power Co. has been incorporated with a capital of $50,000. Frank H. Earl, W. H. Foster and Charles A. Kingsbury are the incorporators.

MILWAUKEE, WIS.—Robert W. Hunt & Co., Rookery Bldg., Chicago, have been selected to prepare plans for the municipal electric lighting plant and to supervise the erection of the machinery. Noted in issue of Oct. 4.

MILWAUKEE, WIS.—Bids are asked by the Board of Public Works until 10.30 a. m., Oct. 13, for lighting certain streets in this city with 60-CP. incandescent street gas lamps.

WAPELLO, IOWA.—The Wapello Electric Light & Power Co. will soon ask bids for constructing a water and light plant, estimated to cost $15,000.

OBERLIN, KAN.—This city will install a city electric light system in connection with the city water-works, which will cost $10,000.

WILLISTON, N. DAK.—The GENERAL ELECTRIC CO., of Schenectady, N. Y., has been awarded the contract to furnish material and machinery for the electric generating plant of the power and pumping system in the Williston irrigation project. The bid was $41,242.

GRAND FORKS, N. DAK.—EDWARD HEALY, of Red Lake Falls, has been awarded the contract to erect the new power plant which is to transmit electricity from Red Lake to this place.

MARYVILLE, MO.—See under Water Supply and Irrigation.

BOONEVILLE, ARK.—THEO. C. TREADWAY, of the Treadway Electric Co., of Little Rock, will erect a municipal electric light plant in this city. The plant will probably be in operation by Nov. 15.

CORPUS CHRISTI, TEX.—It is reported that George Adt, representing a Chicago company, has applied for franchise to establish a $40,000 gas plant.

MEXIA, TEX.—The Mexia Light & Water Co. has been incorporated with $100,000 capital stock by Joseph Nussbaum, H. O. Cravens of Mexia and E. M. Turner of Hillsboro, Tex.

TEXARKANA, TEX.—The charter for the Citizens' Light & Power Co. has been filed, for the purpose of installing a plant to furnish electric lights and electric power to consumers in Texarkana. The capital is $50,000, and the following are the incorporators and directors: John B. King, Roland Rogers and Scott B. Williams, William P. Harrison and C. C. Taylor.

DURANT, IND. T.—The City Council has accepted the proposition of L. S. Skelton, of Okmulgee, to erect and operate a gas plant in this city.

GREELEY, COLO.—Tax payers voted by a large majority on Sept. 25 in favor of granting the Greeley Gas & Electric Co. a franchise. The company will now issue bonds, enlarge its plant, build a new power house and install a new system of making gas. About $40,000 will be expended.

GRANITE FALLS, WASH.—The Everett Railway, Light & Power Co., of Everett, is contemplating the construction of a hydro-electric plant here. The plant will have a capacity of 4,000 HP., and will cost about $350,000. The electrical machinery has been ordered and it is hoped to have the plant in operation within a year. E. P. Burch is Consulting Engr., and J. T. McChesney is Pres. and Mgr.

ROSALIA, WASH.—Arthur D. Jones, of Spokane, has applied for an electric light franchise at this place. The chief promoter of the scheme is the Spokane & Inland Electric Railway Co. A. N. Lupper is Ch. Engr.

TACOMA, WASH.—A. L. Thorn, City Electrician, has completed plans for a reinforced concrete substation, to be erected on South 25th and C Sts., to cost between $15,000 and $20,000.

RED BLUFF, CAL.—The Northern California Power Co. has purchased the 160-acre ranch of I. N. Gould above Plateau, on the Shingletown Ridge, and will turn the 1,400 inches of water with the place, into the penstock of the Volta power plant at Manton. This will give greater capacity to the plant, which will soon have another power house built near the present plant. E. V. D. Johnson, of Redding, is Pres.

SANDPOINT, IDAHO.—The Sandpoint Citizens' Water, Light & Power Co., Ltd., has been incorporated with a capital stock of $150,000. The incorporators are George Heaton, Robert Coons, Lee L. Partner, Frank C. Culver and B. S. Difenbach.

SALT LAKE CITY, UTAH.—A. M. Hill, A. P. Hanson and L. H. Gray have filed an application for water rights for a flow of 110 cu. ft. a second, to be diverted from the Blacksmith fork of Bear River, in Cache County. The diverting work will consist of a dam, headgate and pipe line 8,000 ft. long and 18 ins. in diameter. Two hydro-electric units wil be installed.

GRAVENHURST, ONT.—It is reported that contracts for the proposed electric light plant have been awarded as follows: Electrical apparatus, to ALLIS-CHALMERS-BULLOCK CO., of Toronto; water wheels, to JENCKES MACHINE CO., of Toronto, and steel flume to CANADA FOUNDRY CO., of Toronto. Contracts for pole line and receiving station not yet let, and no date yet fixed for receiving bids for same.

NEW WESTMINSTER, B. C.—The Chilliwac Light & Power Co. will at once proceed with the construction of a power line from here to Chilliwac. J. Burtt Morgan is Mgr. and Secy.

BRIDGES.

The names of parties awarded contracts are printed in capital letters.

DANVERSPORT (Danvers post-office), MASS.—The Essex County Commissioners have decided not to award any contract for completing the construction of the Waters bridge at Danversport. Bids were received from John Sullivan, Danvers, $13,800; James J. Welch & Co., Salem, $17,416, and Pitman & Brown Co., Salem, $15,965. Mr. Sullivan agrees to complete the work Jan. 2, 1907, and the others name Jan. 1, 1907. The Legislature originally authorized the expenditure of $25,000, and the commissioners expended in all $31,500. They paid the same, and bills to the amount of $10,000 additional were contracted and are still unpaid.

BRADFORD, R. I.—Bids were received at the Bureau of Equipment, Navy Dept., Washington, D. C., Oct. 3, for construction of steel bridges, timber trestle and cable railway track at the U. S. Naval Coal Depot, Narragansett Bay, Bradford, R. I. Bids were as follows: Augustus Smith, 149 Broadway, New York, $15,528; Monongahela Mfg. Co., 15 Liberty St., New York, $16,970; New Jersey Foundry & Machine Co., 9 Murray St., New York, $16,964 (conditional), $17,064 (unconditional).

HOOSICK FALLS, N. Y.—We are officially advised that M. FITZGERALD, Hoosick Falls, has contract to construct concrete bridge. The cost is not to exceed $27,000. W. P. Haynes is Town Clk.

ALBANY, N. Y.—The Canal Board, state of New York, has approved plans and specifications for Barge Canal Contract No. 16, which embraces the work of furnishing and erecting in place steel highway bridge superstructures, as follows: Bridge at Station 293 + 90; Comstock's bridge, Station 392 + 50; Dewey's bridge, Station 468 + 0; Fort Ann bridge, Station 600 + 26; Brayton's bridge, Station 687 + 11; Smith's Basin bridge, Station 914 + 0; Dunham's Basin bridge, Station 1048 + 70; East St. bridge, Station 1187 + 0; Argyle St. bridge, Station 1218 + 85; bridge below Lock 7. Engineer's estimate is $70,718. Henry A. Van Alstyne is State Engr. Bids will be asked by N. V. V. Franchot, Supt. Pub. Wks., Albany, shortly.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Oct. 18, by the Park Board, Moses Herrman, Pres., for erecting a rubble stone foot bridge in the Botanical Garden in Bronx Park.

KENNERDELL, PA.—The following bids are reported to have been received Sept. 21 by the Board of Commissioners, H. M. Baumgarden, Chn., for furnishing material and constructing a bridge across the Allegheny River at Kennerdell. The superstructure to consist of two half-through steel plate girder spans, 60 to 80 ft. long respectively, and three through steel truss, channel spans, 200, 260 and 260 ft. long respectively, with 18-ft. clear roadway and reinforced concrete floor throughout; substructure to consist of two channel piers and two shore piers of stone, with concrete backing and bases and steel towers at intersection of plate girders; approaches to consist of about 4,200 yds. natural earth or rock filling; one of the approaches to be confined within concrete walls, the other rip-rapped: AMERICAN BRIDGE CO., 42 Broadway, New York, N. Y., $69,660 (awarded contract); Canton Bridge Co., $80,000; Penn Bridge Co., $75,045; New Jersey & West Virginia Bridge Society, $74,238; Rogers Bros., Albion, Pa., $74,914; Pennsylvania Steel Co., $75,882; Toledo-Massillon Bridge Co., $76,887; Nelson Construction Co., $78,021; York Bridge Co., $86,443; McClintic-Marshall Construction Co., $87,914.

READING, PA.—Bids are asked until 10 a. m., Oct. 19, by H. F. Livingwood, County Controller, for replacing bridge over Berkley Creek with a steel 60-ft. span. The substructure is to be of concrete and the walls of rubble masonry. (Advertised, Engineering News.)

SEWICKLEY, PA.—W. Y. Sibert, Government Bldg., Pittsburg, Pa., is reported to have had surveys made and is considering plans for the erection of a bridge over the Ohio River at Sewickley. The bridge will have a 900-ft. span and will cost $450,000.

EAST BERKLEY, PA.—We are officially advised that all bids received for rebuilding bridge over Willow Creek have been rejected. New plans are being prepared. N. M. Davis is Des. Engr.

UPPER MARLBORO, MD.—It is reported that the County Commissioners have awarded contract for constructing the concrete substructure of the steel bridge over the Patuxent River at Hill's bridge to the ROYK BRIDGE CO., at $2,923, and the contract for the superstructure of the same bridge to the CANTON BRIDGE CO., at $4,392.

WASHINGTON, D. C.—Bids were opened at the office of the Commissioners of the District of Columbia, Washington, Oct. 3, for furnishing the steel railing for the Connecticut Ave. bridge, Washington. Bids were as follows: North Penn Iron Co., Third and Venange Sts., Philadelphia, Pa., $5,560; Fred S. Gichner, 1214 D St., N. W., Washington, $5,850; C. A. Schneider's Sons, 210 12th St. N. W., Washington, D. C., $6,760; Ralph C. Hoag & Co., Philadelphia, $7,270; J. L. Mott Iron Works, Home Life Bldg., Washington, $7,567; New Jersey Foundry & Machine Co., 9 Murray St., New York, $9,440; Chesapeake Iron Works, Severn and Bayard Sts., Baltimore, $8,000, reduced later to $7,550 by telegraph dispatch.

SCOTTSVILLE, VA.—ROANOKE BRIDGE CO., of Roanoke, Va., has contract at $22,000 for the construction of bridge across the James River, connecting the counties of Albermarle and Buckingham.

EDENTON, N. C.—The Norfolk & Southern R. R. Co. will build a bridge across Albemarle Sound and Johnson and Mackey's Creeks at Edenton, N. C. The Government Commission has acted favorably on the application for permission to erect the bridge, and requires that the structure have two draw spans, each 140 ft. wide in the clear; one of these spans must be 5,500 ft. from the north shore and the other 6,500 ft. from the south shore. In addition to the draw spans, two small passageways for motor boats will be provided. J. A. Barron, Berkley, Va., is Supervisor of Bridges and Buildings.

COLUMBIA, S. C.—Bids are asked by the Supervisor until Oct. 15 for building a bridge over Little River, 17 miles from Columbia. Also bids will be received at same time to build a bridge over Crane Creek, six miles from Columbia.

MONROE, LA.—The Vicksburg, Shreveport & Pacific Ry. Co. has awarded contracts to A. M. BLODGETT, and work has been commenced on the reconstruction of the bridge over the Ouachita River near Monroe. The new structure is of steel, 901 ft. long and 16 and 18 ft. wide in the clear. It is estimated to cost $197,750. There is one draw span 295 ft. long; two fixed pin truss spans each 243 ft. long and one fixed pin truss span 120 ft. long. The structure is designed to carry two 90-ton 2-8-0 locomotives followed by a load of 4,000 lbs. per lin. ft. The piers are of concrete and brick. Two cylinder piers of the old structure are to be replaced at either end of the structure by concrete abutments. E. L. Loftin is Supv. of Buildings and Bridges, Vicksburg, Miss.

ST. CLAIRSVILLE, OHIO.—Bids are asked by A. W. Beatty, County Audr., until 1 p. m., Oct. 22, for furnishing material and erecting several bridges.

TOLEDO, OHIO.—Bids are asked until 10 a. m., Oct. 29, by the Board of County Commissioners of Lucas County, at Toledo, for constructing bridges over Miami and Erie Canal in various townships.

EATON, OHIO.—Bids are asked by the County Commissioners of Preble County until Oct. 20 for the erection of a bridge superstructure across Four Mile Creek at the Charles Ford near the center of Section 28, Dixon Township. Fred Roberts is Engr. C. W. Edison is County Audr.

WAUSEON, OHIO.—Bids are asked until Oct. 26 by J. E. Merrill, Audr., for constructing a bridge in Franklin Township, the superstructure of which will be 100 ft.; also a bridge having a 40-ft. superstructure.

CLEVELAND, OHIO.—Bids are asked until Oct. 12 by the Board Public Service for constructing pile and timber protections for Jefferson Ave., S. W., bascule bridge. J. B. Vining is Secy.

Two bridges, one to cross the flats at Clark Ave., S. W., and the other to cross Morgan Run. The first, it is estimated, will cost about $1,000,000.

TROY, OHIO.—The County Commissioners on Sept. 29 awarded the contract for superstructure of the bridge over the canal on Union St., Troy, to the WYNKOOP & McGOVERNLY BRIDGE CO., Toledo, at $5,375. No contract has been made. There was one other bid from Huston & Co., of Cleveland, for $6,025. The bridge is to be 53 ft. long, having a roadway 18 ft. in the clear and a 5-ft. sidewalk on each side. It will have a capacity of 150 lbs. live load. The roadway is to have 3-in. creosote blocks laid on 3-in. creosote plank. The walks are to have 2-in. plank floors.

MICHIGAN CITY, IND.—A contract has been awarded to JOHN J. O'HERON, of Chicago, for the construction of a bascule bridge over the harbor at Franklin St. Price, $65,000.

BLUFFTON, IND.—It is reported that the Wells Conty Commissioners have appropriated $15,000 for a bridge across the Wabash River at Main St.; the City Council has made an appropriation for several smaller bridges.

INDIANAPOLIS, IND.—The contract for construction of a bridge over White River at College Ave. has been let to A. W. MOORE & CO., by the County Commissioners, at $58,630. The bridge will be built of stone.

PEORIA, ILL.—The MARSH BRIDGE CO., Equitable Bldg., Des Moines, Iowa, presented the lowest bid at $150,280 for the construction of the proposed new bridge. The Concrete Steel Engineering Co., Park Row Bldg., New York, N. Y., prepared the plans.

PEORIA, ILL.—Bids are asked until noon, Nov. 6, by E. A. Furry, Commissioner of Pub. Wks., for constructing superstructure of a Scherzer rolling lift bridge across the Illinois River, at Peoria. (Advertised, Engineering News.)

GALENA, ILL.—A. R. IVES, of Galena, has been awarded the contract to build a draw bridge over the Galena River at this town. It will cost $9,600.

DULUTH, MINN.—It is reported that a $12,000 bridge is to be constructed in Lincoln Park. R. D. Rayer, Commissioner.

KANSAS CITY, MO.—A movement is on foot to construct a viaduct from 20th to 23d St., on Main St., across the belt-line tracks. The Central Improvement Co. has charge of financing and building this viaduct, which is to be 60 ft. wide, 1,320 ft. long, and will cost in the neighborhood of $125,000.

EVENING SHADE, ARK.—The County Judge has approved the report of the Commissioners, recommending that a county bridge be constructed across Strawberry River. The bridge will be constructed of steel.

TEXARKANA, ARK.—J. E. Edwards, Judge of Miller County, is having plans drawn preparatory to an estimate as to the cost of a bridge to span Sulphur River. The bridge contemplated will have a total length of one mile. The portion of the bridge spanning the channel of the river will be of steel, and constructed after the best approved models in bridge building.

PINE BLUFF, ARK.—The Jefferson County Levying Court has appropriated $20,000 for continuing the work upon the free bridge which is to be built across the Arkansas River at Pine Bluff.

AUSTIN, TEX.—The Texas Pacific and Abilene & Northern Ry. Co. will join in the expense of an overhead grade crossing of their tracks at Austin. The expense is estimated at $20,000.

LAMPASAS, TEX.—It is reported that bonds to the amount of $10,000 will be issued by Lampasas County for building two bridges across Lampasas River.

TEMPLE, TEX.—The City Council has advertised for bids for the construction of a concrete aqueduct or bridge over First St., the full width of the street, 80 ft.

GALVESTON, TEX.—The Galveston Bridge & Causeway Co. is furthering its plans for the erection of a causeway across Galveston Bay. At the meeting on Sept. 20, officials from the engineering department of various steam and electric railroads were present and the plans were considered. It was recommended that the causeway be 20 ft. above mean low tide, and that all riprap work which has been contemplated be replaced by reinforced concrete construction.

DALLAS, TEX.—It is reported that the Houston & Texas Central Railroad Co. will build a viaduct over Pennsylvania Ave. T. Fay, Houston, is Gen. Mgr.

PORTLAND, ORE.—The contract for constructing a steel bridge on Grand Ave. has been awarded to the INTERNATIONAL CONTRACT CO., 737 New York Block, Seattle, Wash., for $51,736. Thomas C. Devlin, City Audr.

OSWEGO, ORE.—It is reported that the Southern Pacific Co. intends to change its tracks so as to enter Portland on the east side of the city, which would require a bridge across the Williamette River at Oswego.

SPOKANE, WASH.—The Spokane Traction Co. is reported to have submitted plans to the City Council for constructing a viaduct on North Washington St. Estimated cost, $180,000. Alexander Lupper is Ch. Engr.

ABERDEEN, WASH.—Bids are asked by the City for constructing a bridge on the Montesano Road. The bridge will be 484 ft. long, including the approaches. One of the approaches will be 192 ft., and the other 96 ft. The bridge proper will consist of two spans, each 48 ft. long, and will be built of wood.

HOPEWELL CAPE, N. B.—Bids are asked until Oct. 22 by C. H. La Billois, Dept. Pub. Wks., Fredericton, N. B., for building the Mill Creek Mouth bridge.

GORDON, ONT.—We are officially informed that contract for constructing superstructure of steel bridge over Grand River, on Sept. 20, was awarded to JENKS & DRESSER, at $3,630. Contract for constructing abutments, etc., was let to REMIE LAFRAMBOISE, at $2,880. A. C. Mailloux is Township Clk.

TORONTO, ONT.—Bids are asked until noon, Oct. 16, by Emerson Coatsworth, Chn. Bd. of Control, for constructing superstructure and stairways for the Wallace Ave. bridge. C. H. Rust is City Engr.

OTTAWA, ONT.—It is the intention of the Department of Public Works to construct a foot bridge from Parliament Hill, across the junction of the Rideau Canal with the Ottawa River, to the lower end of Major Hill Park, so as to bring the several departmental buildings into as close a touch as possible with one another and with the Houses of Parliament.

BUILDINGS.

The names of parties awarded contracts are printed in capital letters.

PORTLAND, ME.—Bids are asked until 3 p. m., Nov. 8, by James Knox Taylor, Supervy. Arch., Washington, D. C., for constructing quarantine buildings and wharf at House Island, Portland. (Advertised, Engineering News.)

BURLINGTON, VT.—An office building to cost $100,000, is to be erected here. It is to be a 5-story steel building 60 x 117, to be erected on Third and Valley Sts.

HAVERHILL, MASS.—Contracts are soon to be awarded for the erection of the $165,000 high school.

PROVIDENCE, R. I.—This city is to build a hospital to cost at the outset $175,000. The present private hospital accommodations are inadequate and contagious disease patients are being barred out.

ALBANY, N. Y.—The Trustees of Public Buildings have awarded to the RICHARD T. FORD CO., of Rochester, N. Y., the contract for finishing and installing new system of plumbing in the Capitol Building, for $22,712, that company being lowest bidder. George L. Heins is State Arch.

NEW YORK, N. Y.—Bannister & Schell, Archs., 69 Wall St., have plans ready for bids for a bank building on the south side of 125th St., 300 ft. east of Park Ave., for the Harlem Savings Bank, 2279 Third Ave. One and three stories high, 80 x 101 ft., of brick, stone and marble, structural steel, fireproof construction. Estimated cost, $150,00.

Bids are asked by John H. O'Brien, Fire Comr., 157 East 67th St., until 10.30 a. m., Oct. 19, for the following: For furnishing all the labor and materials required for the erection and completion of a new building for Engine Company No. 120, to be located on the southerly side of Eleventh St., Boro. of Brooklyn.

Plans have been filed with the Superintendent of Buildings for a 3-story public bath building, to be erected at Cherry and Oliver Sts. It is to have a frontage of 50 ft. and a depth of 100 ft., with a handsome pilastered facade of brick enamelled in French gray and trimmed with limestone and terra cotta and abundantly lighted by many windows. There will be two floors of baths for men and women, fitted with scores of shower and tub baths. The third floor will be equipped with a gymnasium, and the building will also have a roof garden. It is to cost $125,000. Horgan & Slattery are the Archs.

Plans have been filed for the 13-story apartment house to be built at the southeast corner of Park Ave. and 58th St., for the Densmore-Compton Building Co., of which Darsa J. Densmore is Pres. The structure will be 120 x 82 ft. and will cost about $325,000. C. W. Buckham, 307 Fifth Ave., is Arch.

A new theater is to be erected by Myer R. Bimberg on Flatbush Ave. directly opposite the tunnel terminal of the Long Island R. R. Estimated cost, $250,000.

Lord & Hewlett, Archs., Fifth Ave. and 77th St., have plans for the proposed $3,000 000 Municipal Building which is to be erected in Murphy Park, Boro. of Brooklyn.

UTICA, N. Y.—Bids are asked until 3 p. m., Oct. 24, by the State Commission in Lunacy, Capitol, Albany, for construction, heating plumbing and electric light wiring and feeder cables for Acute Hospital Building at Utica; also for construction of conduit and outside lighting system at the State Hospital, Utica. T. A. McGarr is Secy of the Comn.; George L. Heins, Capitol, is State Arch.

NEW YORK, N. Y.—Bids are asked by John H. O'Brien, Fire Comr., until 10.30 a. m., Oct. 17, for the erection of a building, and extension for a hook and ladder company to be located on Ralph Ave. near Bergen St., Boro. of Brooklyn.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Oct. 22, by C. B. J. Snyder, Supt. of School Bldgs., for constructing Public School No. 13, on Anderson St., between Pennsylvania and Clifton Aves., Rosedale, Borough of Richmond.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Oct. 30, by James Knox Taylor, Supv. Arch., Washington, D. C., for installing an electric passenger elevator and approaches to replace freight elevator in U. S. post-office and court-house, New York. (Advertised, Engineering News.)

TRENTON, N. J.—C. J. Baxter, State Supt. of Schools, writes us that the State Board of Education will not receive bids for the new State Normal School until the last of November or the first of December. Noted fully in last week's issue.

MONTROSE, PA.—A. E. BADGLEY, Binghamton, N. Y., has been awarded the contract for a 2-story brick and stone Library for the Susquehanna Historical Society.

PHILADELPHIA, PA.—CRAMP & CO. have been awarded the contract at $300,000 to erect the 4-story granite, brick and reinforced-concrete theater for the Broad Street Realty Co. It is to be known as the Edwin Forrest Theater.

PITTSBURG, PA.—Bids are being received by F. H. DeArment, Arch., for an 8-story reinforced concrete apartment building, 91 x 125 ft., to be built at Alder and Spahr Sts., near the Hotel Lamont. J. T. Kyle and others are back of the project and it is estimated that the building will cost $200,000. Concrete is figuring largely in building operations of this city, but this is the first apartment house to be built of that material.

SCRANTON, PA.—Horace Trumbauer, Land Title Bldg., Philadelphia, is preparing plans for a 4-story brick, stone and steel memorial home for aged, for M. Maloney. Estimated cost, $150,000.

WAYNESBURG, PA.—Robinson & Winkler, Archs., House Bldg., Pittsburg, have let general contract to the DUQUESNE CONSTRUCTION CO., Bessemer Bldg., Pittsburg, for a 4-story, brick and stone bank building, 20 x 120 ft., for the People's National Bank, J. A. Dunn, Cashier. Estimated cost, $100,000.

WILMINGTON, DEL.—The Delaware Trust Co. will soon have plans started for a 1-story stone and steel, fireproof bank building at Ninth and Market Sts. Estimated cost, $100,000.

BALTIMORE, MD.—The contract for the new car barn for the United Railways and Electric Co. at Edmondson Ave. and Calverton Rd., has been awarded to J. HENRY MILLER, 110 Dover St. The structure will cost about $125,000, and will be the first of the five houses upon which will be expended $500,000 by the railways company. It is to be a 1-story, reinforced concrete building, 230 x 295 ft. Simonson & Pietsch, American Bldgs., are Archs.

C. E. Cassell & Son, Archs., Law Bldgs., are preparing plans for a 4-story brick addition to a department store at 311-13-15 Martin St., for Bernheimer Bros.

Baldwin & Pennington, Archs., Professional Bldg., are preparing plans for a brick and steel warehouse for the Board of Public Works. Estimated cost, $225,000.

WASHINGTON, D. C.—The contract for the erection of a 10-story office building for W. B. Hibbs & Co., to be erected on 15th St., has been awarded to the GEORGE A. FULLER CO.

The National Metropolitan Citizens' Bank, E. S. Barker, Pres., is considering the enlarging of its building now being erected by increasing its frontage 40 ft. The present building will cost $300.000, and the addition will cost about $250,000 more.

Wyeth & Cresson, Archs., 1517 H St. N.W., are preparing plans for a 4-story brick and stone residence at 24th and U Sts. for J. H. Hammond. Estimated cost, $200,000.

The GEORGE A. FULLER CO., Munsey Bldg., has received the contract for an 8-story brick, stone and steel bank and office building, 50 x 160 ft., for the Union Trust Co. Estimated cost, $600,000.

JAMES L. PARSONS, 13th and Pennsylvania Aves., has received the contract for the Hotel Congress Hall at B St. and New Jersey Ave. for the Congress Hall Hotel Co. It is to be a 10-story brick, stone and steel building of fireproof construction. Estimated cost, $350,000.

The Warwick Hotel Co. has invited plans from local and New York Architects for their new 10-story brick, stone and steel fireproof hotel at Penna. Ave. and 14th St. N. W. Estimated cost, $400,000.

Architects F. M. Day & Bro., 925 Chestnut St., Philadelphia, are preparing plans for a 3-story brick, stone and steel fireproof Hospital for Consumptives for the District of Columbia. Estimated cost, $100,000.

PORTSMOUTH, VA.—Wood, Donn & Deming, Archs., 808 17th St. N. W., Washington, D. C., are preparing plans for remodeling the U. S. Naval Hospital. A 4-story brick, stone and steel and fireproof building is to be constructed at a cost of $300,000.

SEEBERT, W. VA.—Bids are asked until Oct. 15, for the erection of edifice to be owned by the Methodist and Presbyterian churches.

RAYNE, LA.—Bids are asked until Oct. 13, for depot to be erected by the Opelousas, Gulf & Northeastern Railway Co. C. C. Genung, Opelousas, La., is Ch. Engr.

LOUISVILLE, KY.—Charles T. Ballard, Thruston Ballard, Thomas F. Smith, Thomas Bohannon, William Booker, Lewis Wymond and others have purchased 350 acres of land, which will be improved by the erection of clubhouse, polo grounds, golf course, tennis courts, swimming pool. About $100,000 will be expended.

ATHENS, OHIO.—Bids are asked by L. M. Jewett, Secy Board of Trustees, Ohio University, Athens, until noon, Oct. 18, for furnishing labor and materials to erect the women's dormitory and the installing of a central heating plant. Frank L. Packard, Columbus, Ohio, is Arch.

CANTON, OHIO.—Bids are asked until Oct. 15, by the Board of Public Service, for both heating by steam and lighting by electricity or gas, the city hall, old market house, police station, central engine house and the auditorium buildings. B. F. Faust is Clk.

BLOOMINGTON, IND.—Bids are asked by the Commissioners of Monroe County, until Nov. 8, for the construction of a modern courthouse. Wing & Mahusin, Ft. Wayne, are Archs.

INDIANAPOLIS, IND.—Bids are asked by the Commissioners of the Deaf and Dumb Institute, Room 81 State House, until noon, Oct. 17, for plumbing the new building. Rubush & Hunter are Archs.

Bids are asked by the Board of Commissioners for Southeastern Hospital for Insane, Room 81, State House, until Nov. 9, for all hardware to equip the various buildings according to plans and specifications. Foltz & Parker, Union Trust Bldg., Archs.

CHICAGO, ILL.—The Chicago & Northwestern Ry. Co. will build a new station on the west bank of the Chicago River, to occupy several entire blocks between Canal and Clinton Sts. and Madison St. and Milwaukee Ave. The new station will contain 16 or 17 tracks, each capable of holding trains of from 12 to 15 cars. The approaches to the station will be on an elevated structure, so that trains may arrive and leave at full speed, all grade crossings being eliminated inside the city limits. Solid blocks of property for several miles have been purchased between the present tracks and the new entrance, which will be used for industrial development. The entire work will cost about $20,000,000, and will require about two years to complete. Edward C. Carter, Ch. Engr., is in charge of the project.

CHICAGO, ILL.—D. H. Burnham & Co., Archs., Railway Exchange Bldg., Jackson Boulevard and Michigan Ave., have completed plans for a field house to be built in one of the new small parks at 46th Place and Princeton Ave., known as No. 4 Square, for the South Park Commissioners, office in Washington Park, Cottage Grove Ave and 57th St. J. F. Foster is the board's superintendent, and has charge of the work. It will cost $70,000 to $80,000. Bids are now being received.

Holabird & Roche, Archs., Monadnock Block, have prepared plans for a store and office building to be built on the vacant lot on the east side of Dearborn St., just north of the Real Estate Board Bldg., Dearborn and Randolph Sts., for Lyman, Lyman & Lovell, represented by Aldis & Co. It will be ten stories, 110 x 40 ft., of fireproof steel construction, have pressed brick and terra cotta fronts, composition roof, hardwood finish, steam heat, electric light, marble and tile work, and is estimated to cost $200,000.

DECATUR, ILL.—The Pythian Home Committee, representing the Grand Lodge of the Knights of Pythias, E. R. Wright, secretary, Taylorville, Ill., invites architects to submit sketches, with elevations, for a Pythian home for widows and orphans to be built on 40 acres of land at Decatur, Ill. It is to be known as the administration or main building, have sufficient rooms and dormitories for present needs, and cost $100,000 to $150,000. The compensation for the successful architect will be such as the committee may consider reasonable. The committee will meet in Chicago on Nov. 7 to consider the sketches, and if any of them is approved, the same will be recommended to the Grand Lodge, which meets in Chicago on Nov. 8. It is desired that the sketches shall follow as nearly as possible the plans of the Pythian Home at Springfield, Ohio.

CHEYENNE AGENCY, S. DAK.—Bids are asked by the Commissioner of Indian Affairs, Washington, D. C., until 2 p. m., Oct. 31, for furnishing and delivering all the materials and labor required to construct and complete a day school plant at Green Grass Camp, Cheyenne River Reservation, S. Dak.

KANSAS CITY, MO.—The Grand Ave. M. E. Church is considering the erection of a combined church and office building to cost $400,000.

The contract will be let about Dec. 1 for building to be erected by the Young Men's Christian Association, for which Charles A. Smith, 722 Dwight Bldg., has prepared plans. It is to be six stories high, 90 x 132 ft., and of fireproof construction. Estimated cost, $225,000.

ST. LOUIS, MO.—A 16-story building is to be erected at Seventh and Olive Sts. at a cost of $160,000. William A. Gill holds the lease on the property.

LITTLE ROCK, ARK.—The City Council has passed an ordinance for the erection of a city hall to cost not less than $175,000. The building will be erected at Markham and Broadway on a site recently purchased by the city.

COLORADO SPRINGS, COLO.—Plans are being revised by James Knox Taylor, Supervis. Arch., Treasury Dept., Washington, D. C., for the postoffice and Government building at Colorado Springs. Estimated cost of building, $150,000.

DENVER, COLO.—O. L. Johnson, it is stated, has secured a site at Grand Ave. and 14th St., and will erect an 8-story fireproof apartment hotel, to cost about $250,000.

SEATTLE, WASH.—The Standard Furniture Co. is considering the matter of building an 8-story building to cost in the neighborhood of $250,000. Bids will be called for in the near future.

PORTLAND, ORE.—The local Y. M. C. A. proposes to erect a $400,000 building.

LOS ANGELES, CAL.—A. L. Haley, Arch., Henne Bldg., is preparing plans for an 8-story reinforced concrete building at Main and Second Sts., by Thomas Higgins. Estimated cost, $800,000.

LONG BEACH, CAL.—Dr. W. B. Scheurer probably will build a 5-story modern office building to cost $100,000, on the north side of West Second St., between Pacific and Pine Sts. Next to the newly completed Long Beack Bank building this structure is to be the largest business building in the city. J. W. Chalmers is Arch. It is to be a building 50 x 150 ft. of reinforced concrete.

SAN FRANCISCO, CAL.—Frank T. Shea, Arch., has completed plans for an 8-story steel Class A building for J. Parker Whitney. It is to be erected on Geary St. between Grant Ave. and Stockton St., at a cost of $500,000. The steel contract has been awarded to J. R. BOWLES, of Portland, Ore.

NEEDLES, CAL.—A depot and hotel, to cost $150,000, will be at once built by the Atchinson, Topeka & Sante Fe Ry. Co. here to take the place of the structure recently burned at that place. W. E. Hodges, Chicago, Ill., is Gen. Pur. Agt.

MONTREAL, QUE.—Most of the land has been secured, on Dominion Square, Montreal, for the erection of a million dollar hotel, with furnishings to cost one-half million dollars. Work is expected to start on the first of May next. The parties are New Yorkers, and the chief promoter is Wm. H. Buckley, an Albany lawyer, who is son-in-law of James McShane, Harbor Master of Montreal. Mr. McShane has secured the options.

WATERLOO, QUE.—Bids are asked by George Moynen, Chn. School Coms., until Oct. 31, for the construction and the supplying of all material for an academy.

QUEBEC, QUE.—Ph. Beland, Clk. of Works, Post-office Bldg., Quebec, will furnish plans and specifications to parties desiring to tender for the construction of a defection house, defective apparatus, etc., at the Quarantine Station, Grosse Isle, Que. Bids should be addressed to Fred Gelinas, Secy Pub. Wks., Ottawa.

TORONTO, ONT.—Charles E. Treson, who recently took over the Russell House on Yonge St., will commence building operations on a new 12-story hotel structure about May 1. The Russell House building will be used as an annex. This will be the largest hotel building in Canada.

Bids are asked by H. F. McNaughton, Secy Pub. Wks. Dept., Parliament Bldg., until noon, Oct. 13, for the erection of buildings for Normal Schools in Peterboro, Stratford and North Bay.

A new theater will be erected on the site of the present Star Theater on Temperance St. It will have double the seating of the present building. McIlpatrick & Son, Archs., of New York, are at work on the plans, and building will begin with the new year.

OTTAWA, ONT.—The Dominion Government is to erect two large public buildings here at a cost of $3,000,000. Hon. C. S. Hyman, Minister of Pub. Wks., has invited competitive designs for the new buildings, open to all Canadian Architects. Prizes amounting to $15,000 are being offered for the four best plans. Each of the new edifices will be of stone and five stories in height. Between them they will afford a floor space of 225,000 ft. The construction will of stone, steel and cement.

WATER SUPPLY—IRRIGATION.

The names of parties awarded contracts are printed in capital letters.

CORNING, N. Y.—It is reported that a new reservoir will be built at Corning, and the old one will be repaired. J. F. Witmer, Buffalo, is Engr.; W. J. Heermans is Secy. Bd. Water Comrs.

ALBANY, N. Y.—Bids are asked by the Board of Contract and Supply, Albany, until 3 p. m., Oct. 15, for improvement of water supply and for engine foundations and appurtenances at the Quackenbush St. pumping station. Walter E. Melius is City Engr. Isidore Wachsman is Clerk of Board.

BUFFALO, N. Y.—Bids are asked by the State Commission in Lunacy, at Albany, until Oct. 24, for alterations to the water supply system at Buffalo State Hospital. T. E. McGarr is Secy. of Comn.; G. L. Heins is State Arch.

COHOES, N. Y.—We are officially advised that the DEANE STEAM PUMP CO., Holyoke, Mass., on Sept. 19, was awarded contract to install a triplex water power pump of 4,000,000 gallons capacity daily, at $4,260. Henry L. Shaver is Pres. Bd. Water Comrs.

YONKERS, N. Y.—Bids are asked until Nov. 8, by the Board of Water Commissioners, for installing a 6,000,000-gallon high duty pump, at the tube well pumping station. John J. Devitt is Pres.; A. W. Kingsbury is Clk. (Advertised, Engineering News.)

PERTH AMBOY, N. J.—Bids are asked until 8.30 p. m., Oct. 17, by the Board of Water Commissioners, at the City Hall, for supplying a quantity of water pipe. Adam Eckert is Clk.

SUMMIT, N. J.—Bids are asked until 8.30 p. m., Oct. 16, by the Common Council for laying about 7,650 lin. ft. of 14-in. c.-i. force pipe. Edward D. Rich is City Engr. For further information apply at Police Headquarters. Telephone No. 52 Summit. (Advertised, Engineering News.)

ROCHESTER, PA.—CHANDLEY BROS., Beaver Falls, Pa., have been awarded the contract for the construction of the new water-works and filtration plant at Rochester. The plant will have a pumping capacity of 600,000 gallons daily, and a large reservoir wil be constructed.

CONNELLSVILLE, PA.—The CONNELLSVILLE CONSTRUCTION CO., has been awarded the contract for erecting a big addition to the Connelsville Water Co.'s pumping station near Bluestone.

EDINBURG, PA.—We are officially advised that on Oct. 2 C. A. MALONE, of Hollidaysburg, Pa., was awarded contract, at $6,573, for constructing a gravity system of waterworks at Ediburg. The Borough will furnish all pipe and specials. W. A. Wrenn is Chn.

PHILADELPHIA, PA.—Bids are asked until noon, Nov. 7, by Thomas L. Hicks, Dir. Dept. Pub. Wks., for constructing preliminary filters at Belmont station. (Advertised, Engineering News.)

HAGERSTOWN, MD.—The Washington County Water Co. on Oct. 3 awarded the contract to build a 10,000,000-gallon reservoir, on top of Evers' Hill west of Hagerstown, and to construct several new pipe lines, to the WHITMER CONSTRUCTION CO., of Philadelphia. The contract price was in the neighborhood of $300,000. The new reservoir, making the third owned by the company, will be oval, 460 ft. long, 260 ft. wide, with walls 15 ft. high. The walls will be 5 ft. thick at the bottom and taper to 2 ft. thick at the top. The earth embankment, which wil be built against the outside of the wall, will be 16 ft. thick at the bottom and 6 ft. thick at the top. The cement will be 1 ft. thick in the bottom of the reservoir. About 5,000 barrels of cement will be used. A 16-in. c.-i. pipe line, 9½ miles long, will be laid from the Cavetown reservoir, at the foot of the mountain, to the Evers reservoir. A 12-in. pipe line, 9,000 ft. long, will be laid from the east end of Hagerstown to the new reservoir. About 2,000 ft. of 20-in. pipe will be laid from the Evers reservoir to the distributing system in Hagerstown. This will give a capacity of 5,000,000 gallons in 24 hours.

WASHINGTON, D. C.—Bids are asked until Oct. 27 by the Commissioners, District of Columbia, for furnishing and delivering a 42-in. water gate.

NORFOLK, VA.—It is reported that George W. Wright, Ch. Engr. of the Water Department, has submitted plans to the Board of Control for a reserve pump of 8,000 gallons per minute capacity against total head of 40 ft., duty guaranteed, and surface condenser for same located in main suction pipe; steam pressure, 90 lbs.

Bids are asked until 11 a. m., Nov. 3, at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing pumping machinery and accessories for Dry Dock No. 3, at navy-yard, Norfolk. Mordecai T. Endicott is Ch. of Bureau. Specifications are on file at office of Engineering News, New York.

BURLINGTON, N. C.—The city is reported to be considering the installation of waterworks and sewerage system.

PORT ROYAL, S. C.—Bids are asked until 10 a. m., Oct. 23, at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the naval station, Port Royal, 1,000,000 gallons of fresh water. H. T. B. Harris is Paymaster-General, U. S. N.

COLUMBUS, GA.—It is reported that a system of water-works will be constructed here at an early date.

DADEVILLE, ALA.—We are officially advised a water-works system to cost $7,500 will be constructed here. The supply will be brought from a spring ¾-mile distant. Beside the necessary pipe there will be two electric pumps and a stand-pipe needed. J. B. Rylance is Engr.; John Lovelace is City Clk.

COLLINS, MISS.—This town has voted affirmatively the proposed $10,000 bond issue for enlarging water-works system.

OWENSBORO, KY.—It is reported that the city will issue $60,000 additional bonds for extending water mains. E. B. Shifley is City Engr.

WELLSVILLE, OHIO.—The EXCAVATING & CONSTRUCTION CO., of East Liverpool, Ohio, has been awarded the contract for constructing the new intake for the pumping station at Wellsville, at $7,492.

WILMINGTON, OHIO.—J. R. POINDESTER, of Cynthiana, Ky., has been awarded the contract for installing the new water-works here.

LANCASTER, OHIO.—Bids are asked until Oct. 31 by the Board of Public Service for furnishing 31,000 ft. of 8-in. pipe. George Cunningham is Clk.

DAYTON, OHIO.—The Board of Public Service has awarded contract to CHARLES L. ALLEN, of Marion, Ohio, for constructing high pressure water-works system. About $115,000 was appropriated by the City Council for this purpose.

CULVER, IND.—THE NATIONAL CONSTRUCTION CO., of South Bend, is reported to have secured the contract for constructing water-works at Culver, at $8,000.

DANVILLE, IND.—Bids are asked until Oct. 18 for constructing a pumping station at the city water plant. H. W. Dill is City Clk.

DANVILLE, IND.—Bids are asked until Oct. 18, by John W. Shaffner, Engr., for constructing a pumping station at Danville. H. M. Dill is City Clk.

DECATUR, ILL.—Bids are asked by Albert Leach, City Clk., until Oct. 29 for furnishing a compound condensing vertical or horizontal pumping engine of 6,000,000 gallons daily capacity, for the water-works. Daniel W. Mead is Consult. Engr., 738 First National Bank, Chicago.

RANDOLPH, WIS.—LANGSTADT & MEYER CONSTRUCTION & SUPPLY CO., Appleton, has been awarded contract for constructing a water supply system. J. O. Jones is Village Recdr.

WEST BRANCH, IOWA.—It is reported that G. H. Meredith, of Cedar Rapids, is now here surveying and making estimates for the proposed water-works. Thomas Farrell is City Clk.

GARDEN CITY, KAN. — RICHARD CLOUGH, of Colorado Springs, Colo., has been awarded a $100,000 contract to build reservoirs and ditches for the U. S. Sugar & Land Co., at Garden City. Mr. Clough expects to work 250 men and 150 teams this fall.

WILLISTON, N. DAK.—The Secretary of the Interior has closed a contract with JOHN H. DONOHUE, of St. Paul, Minn., providing for construction and completion of building for Station 1, power and pumping station, Williston Irrigation Project, N. Dak. The estimated cost of the work will be $13,886.

BUFORD, N. DAK.—The Secretary of the Interior, as has been stated previously in these columns, has awarded a contract to the D'OLIER ENGINEERING CO., 121 South Eleventh St., Philadelphia, Pa., for furnishing and installing pumping machinery for the Buford-Trenton Irrigation Project, N. Dak. The contract calls for the installation of three transformers of 300 KW. capacity, and eight motor driven pumping units of capacities of 16 and 30 cu. ft. per second under heads of 50 and 33 ft., respectively, with necessary electrical apparatus and water pipes, in pumping stations near Buford, N. Dak. The D'Olier Engineering Co. will receive $40,836 for the work. Now that the contract is let and the exact dimensions of the machinery are known, the engineers will determine on the design of the floating barge in which the intake pumps are to be mounted, and labor and materials will be secured for the construction of the barge. The water supply for this project is from the Missouri River, the slight gradient of which necessitates lifting the water direct from the stream by pumps. No long and expensive canal system will be required. An abundance of lignite fuel exists in the vicinity and it is proposed to generate power at the mines, and transmit it electrically to the several pumping stations for the Buford-Trenton and Williston projects. The first pumps will be placed on floating barges. These will, of course, accommodate themselves to changes not only in water level, but to the shifting of the stream, the water being conducted from the pumps on the barges through pipes with flexible joints to the main canal. Additional substation lifts will be introduced wherever required.

BILLINGS, MONT.—We are officially informed that a municipal water system will be constructed at Billings, to cost about $400,000. About one mile of 18-in. pipe and 3½ miles 20-in. pipe will be needed; also a pump of 3,500 gallons capacity a minute, one pair horizontal 500-HP., 42-in. turbines, concrete head gates and power-house, and three miles canal line, capacity 3,000 cu. ft. a second. The supply will be taken from the Yellowstone River. Henry Gerbarz is City Engr.

PLATTSBURG, MO.—This city has voted affirmatively the proposed $44,000 bond issue for the construction of water-works.

MARYVILLE, MO.—We have been officially advised that Burns & McDonnell, Dwight Bldg., Kansas City, Mo., have been retained to prepare plans, specifications and estimates for water-works and electric light systems at Maryville.

BENTON, ARK.—It is reported that J. F. Lee is considering the installation of waterworks system, the supply to be obtained from an artesian well having a capacity of 300 gallons a minute.

CLARENDON, ARK.—The citizens of Clarendon are taking steps toward the formation of two improvement companies, one for the establishment of a system of waterworks, the other for the establishment of a sewerage system. Petitions for the purpose will soon be presented to the City Council. It is estimated that the improvements will cost about $75,000.

MORRILLTON, ARK.—It is reported that J. C. WILSON, St. Louis, Mo., has contract to construct water-works for the Morrillton Water-Works Co.

FREDERICK, OKLA.—We are officially informed that, on Oct. 4, G. JAEGER, of Rich Hill, Mo., secured contract for constructing a system of water-works in this town, at $23,730. John Carr is Pres. Bd.; W. P. Bullock, 110 Monroe Ave., Kansas City, Mo., is Engr.

CLAREMORE, IND. T.—W. W. COOK & SONS, of Junction City, Kan., have been awarded contract for construction of water-works system, at $35,000, for Claremore.

NOWATA, IND. T.—We are officially informed that plans and specifications for systems of water-works and sewers are being prepared by Burns & McDonnell, Kansas City, Mo.

AULT, COLO.—We are officially advised that during November bids will be asked for constructing a system of water-works. The supply will be taken from wells and will be distributed by an air pressure plant. About two miles of pipe is necessary. Estimated cost, $30,000. G. H. Bradfield is Town Clk.

CREEDE, COLO.—Bids are asked until 7 p. m., Oct. 15, by Walter G. Boyle, Mayor, for constructing a gravity water system for Creede. Eva G. Stowe is City Clk.

PLATTEVILLE, COLO.—A storage reservoir that will furnish water for 40,000 acres of land lying northeast of Platteville is about to be constructed three miles east of this village. Funds are now being subscribed by farmers of that section and turned over to the Platteville Bank as trustee. The reservoir will be one of the largest single projects of the kind in Weld County, and will have a capacity of 500,000,000 cu. ft. of water. The location of the new reservoir is a natural depression in the country, where at wet season water now accumulates into a pond, known as Lake Platteville. At comparatively little cost a dam can be constructed across the lowest bank of this lake, and an outlet ditch cut. The value of the project, when completed, will be $250,000. The business is being done by Alexander Mead and E. G. Kindred, Greeley, handling the project for the farmers. The water will be used through the Buckers, Independent, Platteville and other large irrigation ditches. The supply will be had from the flood waters of a large drainage area in the vicinity of the basin.

SHELTON, WASH.—It is proposed to construct a concrete reservoir with a capacity of 100,000 gallons at Shelton. J. B. Weddell, of Olympia, is Engr.

POMONA, CAL.—It is reported that waterworks will be constructed at Pomona, at a cost of $300,000 to $500,000. Harry Corlette, of Los Angeles, is interested in the matter. A. H. Hoehig, 627 Hellman Bldg., Los Angeles, is Consult. Engr.

BATTLEFIELD, SASK.—A water-works system will be installed at Battlefield. A building will be erected large enough to accommodate an electric light plant.

RED DEER, ALTA.—Paul Paradis, Civil Engr., Calgary, Alta., is reporting on a gigantic irrigation project 60 miles west of Red Deer.

MOOSE JAW, SASK.—We have been officially advised that, on Sept. 17, the following contracts were let in connection with installing a water-works system: Contract A, laying pipe line, FRED. FEY, Moose Jaw, $26,425; Contract B, constructing concrete dam, McNAIR & MARTIN, Moose Jaw, $15,720; Contract C, excavation per cu. yd., G. M. ANNABLE, Moose Jaw, $1.05. John D. Simpson is Secy.-Treas.

SEWERAGE.

The names of parties awarded contracts are printed in capital letters.

BOSTON, MASS.—It is reported that the contract for constructing the Stony Brook conduit, Section 1, has been awarded to METROPOLITAN CONTRACTING CO., 95 Milk St., at $40,965. John J. Leahy is Supt. of Sewers.

NEW BRITAIN, CONN.—The contract for constructing 1¼ miles of sewers and drains, for which bids were received Oct. 1, has been awarded to EVELINE BROS., of New Britain, for about $12,000, the city furnishing the pipe and castings. W. H. Cadwell is Engr. of Sewers.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Oct. 16, by Louis F. Haffen, Pres. of the Boro. of the Bronx, for constructing sewers in various streets throughout the borough.

Bids are asked until 3 p. m., Oct. 18, by the Park Board, Moses Herrman, Pres., for constructing sewers in Central Park.

NIAGARA FALLS, N. Y.—Bids are asked until Oct. 16 by the Board of Public Works for constructing sewers on Cleveland and Ferry Aves., and Porter Road, and for lowering sewers in certain alleys. Walter McCulloh is City Engr.

ALBANY, N. Y.—Bids are asked by the Board of Contract and Supply until 3 p. m., Oct. 15, for following work: Laying a vitrified stoneware pipe sewer in center of Swan St., from 100 ft. north of Colonie St., northerly to sewer in Van Woert St.; a vitrified stoneware pipe sewer in Prospect Pl., from Eagle to Philip St.; a sewer under carriageway of Clinton St., from Catherine St. to Beaver Creek sewer; vitrified stoneware pipe sewer under north sidewalk of Washington Ave., between Pine Ave. North and Manning Boulevard, the work including laying about 90 ft. of 6-in. pipe across Washington Ave. to connect with property on corner of Washington Ave. and Manning Boulevard. Walter E. Melius is City Engr.; Isidore Wachman is Clk. of Bd.

AMSTERDAM, N. Y.—Bids are asked until Oct. 17 for constructing storm sewers in Amsterdam. F. E. Crane is City Engr.

PLAINFIELD, N. J.—Bids are asked until 8 p. m., Oct. 22 (extension of time), by the Common Council for constructing sanitary sewers and pumping station. James T. MacMurray is City Clk.; Andrew J. Gavett is City Surv. (Advertised, Eng. News.)

PATERSON, N. J.—It is reported that FRANK PUGLIA, 20 Ellison St., has secured contract for constructing sewers in Virginia Ave. and East 23d St., and P. MURRAY for constructing the 23d Ave. sewer. H. J. Hardie is City Engr.

ERIE, PA.—PATRICK DOYLE has been awarded contract for constructing a number of 15 and 9-in. sewers. B. E. Briggs is City Engr.

NARBERTH, PA.—The bids received on Oct. 1 by Council for construction of about six miles of terra cotta pipe sewer were as follows: THEO. HARSCH, Narberth, $51,147; T. J. Shea, Jamaica Plain, Mass., $53,331; Berghans & Moffit, Quarryville, Pa., $84,636; George L. Watson, 1414 South Penn Sq., Philadelphia, $72,100, and John P. Hanlon & Co., Real Estate Trust Bldg., Philadelphia, $59,188. Engineers, Albright & Mebus, 908 Land Title Bldg., Philadelphia.

HARRISBURG, PA.—It is reported that J. S. BRADY, Harrisburg, has secured the contract for constructing the 18th St. sewer, at $10,689. James H. Fuertes is Consult. Engr., Harrisburg.

HOPWOOD, PA.—HIRLEMAN & GUARD, Connellsville, Pa., have been awarded the contract for the construction of a sewer, 1,300 ft. in length at Hopwood.

ALLEGHENY, PA.—Contracts to the amount of about $80,000 for sewer work and street improvements were let on Sept. 22. A. V. PURNELL and BOOTH & FLINN secured the greater part of the awards. Charles F. Kirschler is Mayor; John Swan, Jr., is Dir.

BALTIMORE, MD.—The Municipal Board of Awards, City Hall, has awarded contract to M. A. TALBOT & CO., Logansport Ind., for the construction of about ten miles of storm-water drains at their bid of $152,952. This work will be done under supervision of the Sewerage Commission, Calvin W. Hendrick, Ch. Engr., American Bldg., Baltimore. Bids have also been submitted and contract will soon be awarded for an experimental testing plant to be located at Walbrook.

WASHINGTON, D. C.—The contract for constructing sewers in Seventh St., S. W., between E and G Sts., was awarded to E. G. GUMMEL by the Commissioners on Sept. 29.

CHARLESTON, W. VA.—The committee appointed to secure plans and specifications for sewer and street improvements has submitted a report to the City Council calling for an expenditure of $250,000 for proposed improvements. T. Chalkley Hatton, Wilmington, Del., is Des. Engr.

ELM GROVE, W. VA.—Improvements to the sewerage system at Elm Grove have been authorized by the Council, and contracts amounting to $18,000 will be awarded at once. J. E. Raub is the Engr.-in-Charge, and will award contracts.

ORANGEBURG, S. C.—It is reported that W. W. Hawes, City Engr., is making surveys and estimates for the construction of sewerage system.

DAWSON, GA.—Bids are asked until Nov. 6 for constructing sewer system. R. E. Bell is City Clk.

VICKSBURG, MISS.—Bids are asked until 7.30 p. m., Oct. 15, by the Mayor and Aldermen, for constructing sewer in Clima St., from Washington to Monroe St. H. J. Trowbridge is City Clk.

SPRINGFIELD, OHIO.—The Council has authorized the City Solicitor to prepare issue of $200,000 bonds for constructing high and low level and outfall sewers and disposal plant, recently designed by Snow & Barbour, Tremont Bldg., Boston, Mass.

GIRARD, OHIO.—ARMSTRONG, McGLAHLEN & DENNIS, of Warren, Ohio, have been awarded the contract for excavating for and constructing the sewers in District No. 1, at Girard.

CLINTON, IND.—JESSE ROBERTSON, 629 Chestnut St., Terre Haute, Ind., has been awarded the contract for the construction of a $25,000 sewer at Clinton.

ESCANABA, MICH.—Bids are asked until about Nov. 6 for constructing pipe sewers in Escanaba. T. J. Burke is City Clk.; D. A. Brotherton, Escanaba, is City Engr.

CHEBOYGAN, MICH.—Bids are asked until Oct. 12 for construction of 18-in. tile sewer in State St. George N. Case is City Clk.; M. E. Ward is City Engr.

ROCHELLE, ILL.—Bids are asked until 7 p. m., Oct. 17, by the Board of Local Improvements, for construction of about six miles of sewer and a septic tank.

ALBERT LEA, MINN.—Bids are asked until Oct. 25 for constructing sewer. They are to be placed in a 13-ft. excavation. William Berneck is City Engr.

ATCHISON, KAN.—The BOYD CONSTRUCTION CO., of Kansas City, Kan., on Oct. 1 was awarded contract by the city to construct sewer, which will drain the Challis addition, at $23,988.

GEDDES, S. DAK.—Contract for constructing a sewerage system in Geddes has been awarded to KINGSBURY & EDWARDS, Yankton, S. Dak. J. A. Nelson is City Audr.

DEVIL'S LAKE, N. DAK.—Contract has been awarded to JAMES KENNEDY, Fargo, N. Dak., for construction of the sewer system. Cost, about $14,000.

CLARENDON, ARK.—See under Water-Works and Irrigation.

SANTA MONICA, CAL.—The City Engineer has submitted an estimate of $63,000 for constructing main sewer at Santa Monica and an outfall at Hyperion.

LOS ANGELES, CAL.—Bids are asked until 11 a. m., Nov. 19, by the Board of Public Works, for constructing sewer outfall for city of Los Angeles. Horace B. Ferris is Secy. (Advertised, Engineering News.)

DALHOUSIE, N. B.—We are officially advised that MANN & BAXTER, of Campbellton, N. B., have contract to construct, complete, sewer in Dalhousie. Alexander J. Le Blanc is Town Clk.

RICHMOND, QUE.—It is the intention of the City Council to construct a complete sewer system in Richmond.

HAMILTON, ONT.—The Sewer Committee on Sept. 26 decided to expend $13,000 on deepening and improving the mountain drain.

STREETS AND ROADS.

The names of parties awarded contracts are printed in capital letters.

GREENLAND, N. H.—Bids are asked until 5 p. m., Oct. 16, by A. W. Dean, State Engr., at Concord, for grading and surfacing with gravel a portion of the Portsmouth Rd. in Greenland.

WATERBURY, CONN.—It is reported that the Board of Public Works has awarded the contract for paving North Willow, South Elm and Clay Sts., to WARREN BROS. CO., of Boston, Mass., at $7,875.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Oct. 16, by Louis F. Haffen, Pres. Boro. of the Bronx, for regulating, grading and paving various streets.

Bids are asked until noon, Oct. 15, for laying temporary slag or granite pavement upon concrete foundation on a portion of the newly made land east of the bulkhead wall at Rector St. section, North River.

PORT CHESTER, N. Y.—Bids are asked until Oct. 15 by the Board of Trustees for paving Traverse Ave.; also until Oct. 18 for brick paving on North Main St.

AMSTERDAM, N. Y.—We are officially advised that BAIRD & BAXTER, of Amsterdam, have been awarded contract, at $13,695, for paving Lyon St. F. E. Crane is City Engr.

Bids are asked by Henry A. Van Alstyne, State Engr., until noon, Oct. 19, for additional work on the Fonda Road, No. 152, in Montgomery County, and on the Mohawk River Turnpike in town of Amsterdam, Montgomery County.

ALBANY, N. Y.—Bids are asked until noon, Oct. 31, by Henry A. Van Alstyne, State Engr., for improving various public highways. (Advertised, Engineering News.)

ROCHESTER, N. Y.—It is reported that the Common Council has passed ordinances providing for paving a portion of Reservoir Ave.; also constructing cement walks on Sawyer St. Estimated cost of the improvement, $13,000 and $5,000, respectively.

KINGSTON, N. Y.—CORNELIUS CALLANAN, of Kingston, is reported to have secured the contract for constructing a state highway about seven miles in length, between Kingston and High Falls, at $57,000.

BUFFALO, N. Y.—Bids are asked until Oct. 18 by the Department of Public Works for paving portions of Urban, Beacon and Mystic Sts. F. G. Ward is Comr.

SCHENECTADY, N. Y.—The following contracts were awarded at a meeting of the Board of Contract and Supply on Oct. 1: Grading of Gerling St. from Van Vranken to Banker Ave., awarded to JOSEPH H. CLEMENTS, JR.; paving Furman St. between Becker St. and Robinson's line, awarded to the SCHENECTADY CONTRACTING CO., 332 State St.; sidewalks in Springfield Ave. between State St. and a point 900 ft. northerly, awarded to D. R. WOLCOTT. L. B. Sebring is City Engr.

NEW BRUNSWICK, N. J.—The STANDARD BITULITHIC CO., 233 Broadway, New York, N. Y., has been awarded contract for 18,300 sq. yds. of paving.

HOBOKEN, N. J.—Bids are asked until 8 p. m., Oct. 24, by the City Council, for grading, resetting curbs, relaying sidewalks and repaving roadway of Grand St., between First and Second Sts. Belgian block will be used for paving roadway. James H. Londrigan is City Clk.

ATLANTIC CITY, N. J.—The STANDARD BITULITHIC CO., 422 Union Bldg., Newark, N. J., has been awarded contract, at $266,550, for paving Atlantic Ave.

NEW GALILEE, PA.—The PITT CONSTRUCTION CO., Pittsburg, Pa., has been awarded the contract for constructing 7,000 ft. of macadamized road between New Galilee and Wampum, in Beaver County. The contract price was $17,510.

NEW CASTLE, PA.—The contract for paving and grading East St., New Castle, has been awarded to the A. W. WOODS CO., of this town, at $3,053.

PITTSBURG, PA.—Bids are asked until Oct. 23, by the State Highway Department of Pennsylvania, for constructing 15,384 ft. of road, extending from the north line of Oakdale Borough to a point in Steubenville Pike, in North Fayette Township. Joseph W. Hunter is State Highway Comr.

RALEIGH, N. C.—An election will be called to decide the question of issuing $300,000 in bonds for improving and macadamizing the public roads of Wake County.

JACKSONVILLE, FLA.—JOHN N. C. STOCKTON was awarded, by the Board of Public Works, the contract for laying 182,606 sq. yds. of brick paving at a price averaging a fraction over $1.60 per sq. yd. The contract for laying 47,484 sq. yds. of macadam paving was awarded to D. M. BAKER, whose bid for paving six streets with that material ranges from 66⅔ to 90 cts. per sq. yd. Philip Prioleau is City Engr.

ORLANDO, FLA.—We are officially advised that plans and specifications have not yet been completed for paving to be done. It is estimated that the paving which will be of brick and cover 15,000 sq. yds., will cost $20,000. R. W. Hammond is Chn. St. Com.; A. B. Johnson is City Clk.

MONTGOMERY, ALA.—Bids are asked until noon, Oct. 15, for paving Montgomery St., with either vitrified brick, bitulithic or asphalt. R. S. Williams is City Treas. Allen R. Gilchrist is City Engr.

MERIDIAN, MISS.—The COLUMBUS CONCRETE CO., of Columbus, has been awarded contract to lay concrete sidewalk in the business district, at $11,000.

BROOKHAVEN, MISS.—For grading 21 miles of roadbed. (See under Railways: Natchez & Eastern R. R.)

SHREVEPORT, LA.—The City has let contract to R. N. McKELLAR, at $2.14 per sq. yd., for paving Marshall St. with brick, approximating 3,412 sq. yds.; also to S. W. LETSON for one year's work of laying concrete curb and sidewalk.

TOLEDO, OHIO.—The Board of Public Service is reported to have awarded the contract on Sept. 18 for paving a portion of Wakeman St. to WILLIAM McMAHON, at $6,831.

YOUNGSTOWN, OHIO.—Bids are asked until Oct. 15 by the Board of Public Service for furnishing material and repairing about 4,000 sq. yds. asphalt. G. T. Prosser is Clk.

LONDON, OHIO.—The BLUFFTON CRUSHED STONE CO., of Bluffton, Ohio, has secured the contract for paving with brick Ashland and Rochester Sts., at $5,252 and $5,465, respectively.

CINCINNATI, OHIO.—It is reported that the Board of Public Service on Sept. 26 awarded the following paving contracts: With brick, Providence St., M. FLYNN, $4,434; with brick, Beldare Ave., WILLIAM FOGARTY, $5,364; with boulders, Dayton St., JAMES AGNESS, $7,896. M. J. Keefe is Clk. Bd. Pub. Service.

CINCINNATI, OHIO.—The lowest bid received Oct. 8 by the Board of Public Service, for grading and improving Werk Road, was that submitted by FRED. HEUGEHOLD, Cheviot, Cincinnati, at $21,320. M. J. Keefe is Clk. Bd.; Charles N. Dannenhower is City Engr.

PORTSMOUTH, OHIO.—KELLY BROS. have secured contract to pave Market St. with Portsmouth block, cement curb and gutter, at $6,500, and Fifth St. with the same material at $12,831. Benjamin C. Bratt is City Engr.

TIPTON, IND.—Bids are asked until 8 p. m., Oct. 16, by the Common Council, for constructing brick roadway and cement sidewalk on East St. Clyde Porter is City Clk.

TERRE HAUTE, IND.—Bids are asked until 11 a. m., Oct. 20, by the Commissioners of Vigo County for grading and graveling Roads 6, 7 and 8 in Lost Creek Townships. Jerome W. Denehie is Audr. Vigo County.

EAST ST. LOUIS, ILL.—Bids are asked until noon, Oct. 13, by the Board of Local Improvements for grading and paving 22d St., from State St. to Illinois Ave. E. J. Eggmann is Clk. of Bd. W. J. Crocken is City Engr.

PONTIAC, ILL.—The City Council has authorized the purchase of five carloads of brick, to be used for constructing sidewalks in the Second Ward.

VANDALIA, ILL.—Plans are being made for paving Fourth, Fifth and Sixth Sts., between Gallatin and Main Sts.

EVANSTON, ILL.—Bids are asked until Oct. 14, by the Board of Local Improvements for macadamizing certain streets in Evanston. John T. Barker is Pres. of Bd.

MOLINE, ILL. On Oct. 1 the McCARTHY IMPROVEMENT CO. secured the contract for another paving job in the city of Moline. The contract calls for paving Eighth Ave. from 17th to 18th Sts., and 18th St. from Fourth to Eighth Aves. The pavement will be of asphalt and will cost $11,738. Clark G. Anderson is City Engr.

STREATOR, ILL.—At a meeting held Sept. 28, the Board of Local Improvements let paving contracts for several streets as follows: Shabbona St., from Bridge to Grant Sts.; contract let to JOHN S. BAER, at $14,500. Lundy St., from Sterling to Illinois Sts.; SMITH & SWARTZ, $1.37¼ per sq. yd. Watson St., from Sterling to Illinois Sts.; SMITH & SWARTZ, $1.21½ per sq. yd.

RACINE, WIS.—The Council is considering ordinances for paving 25 streets or portions thereof, and for grading 19 streets. Estimated cost, $25,000.

OSHKOSH, WIS.—McCUGO & BRUETT have secured contract for construction of cement sidewalks for the Chicago & Northwestern Ry. Co., at Oshkosh. About 15,000 ft. will be laid.

DES MOINES, IOWA.—Bids are asked by the Board of Public Works, until 11 a. m., Oct. 18, for constructing about 6,734 sq. yds. of sheet asphalt pavements on West Fourth St. Bids will be received at the same time for constructing about 1,027 sq. yds. of asphalt pavement on Washington St.

Bids are asked until Oct. 20 by the Board of Public Works for paving West Fifth St., Des Moines.

DULUTH, MINN.—P. McDONNELL has been awarded contract for paving Commerce St., at $8,430. Thomas F. McGilvary is City Engr.

ST. JOSEPH, MO.—Two paving contracts were awarded Oct. 1 by the Board of Public Works. RACKLIFFE & GIBSON will pave Duncan St., from 20th to 24th Sts., with brick. The PHOENIX BRICK & CONSTRUCTION CO. will pave Lincoln St., from Ninth to Twelfth Sts., with brick.

OKLAHOMA CITY, OKLA.—The following bids are reported to have been received for paving a portion of Tenth St.: Memphis Paving Co., $39,616; Cleveland Trinidad Asphalt Paving Co., $37,546; Barber Asphalt Paving Co., $35,859.

ENID, IND. T.—The contract for 20 blocks of asphalt paving has been awarded to the WARNER-QUINLAN PAVING CO., 438 South Salina St., Syracuse, N. Y., at $25,000.

DALLAS, TEX.—The TEXAS BITULITHIC CO. has been awarded an additional contract for 2,575 sq. yds. of paving.

DENVER, COLO.—The COLORADO PAVING CO., 505 Quincy Bldg., Denver, has secured contract for paving and resurfacing streets in Denver, at $6,737.

ESTACADA, ORE.—Bids are asked by the City of Estacada until 7 p. m., Oct. 25, for grading and macadamizing Broadway from the north side of Third St., south, to the railroad track.

FORT WILLIAM, ONT.—The Council of Fort William has decided to lay granolithic sidewalks at a cost of $47,106. H. S. Hancock is Town Engr.

OTTAWA, ONT.—The BARBER ASPHALT PAVING CO. has contract to pave Dalhousie St., Ottawa, at $7,838.

MANUFACTURING PLANTS.

The names of parties awarded contracts are printed in capital letters.

WORCESTER, MASS.—Plans have been prepared by Edward Topanelian, Arch., State Mutual Bldg., for the erection of a 4-story shop and store building, 66 × 20 ft., at Winter and Harding Sts., for F. Feingold.

PROVIDENCE, R. I.—It is reported that the Peace Dale Mfg. Co. will commence work on a $15,000 addition to its plant soon. The building will be of stone and will cover an area of 160 × 60 ft.

ALBANY, N. Y.—The contract for constructing the large manufacturing plant for the use of the National Tablet Co., on upper Broadway, has been awarded to FEENEY & SHEEHAN, 164 Montgomery St.

NIAGARA FALLS, N. Y.—We are officially advised that the Niagara Electro Chemical Co. will erect a large addition to its plant. It will be 60 × 208 ft., brick and steel construction. Plans have been prepared by Robert C. Fayfield, Arch., Ellicott Square Bldg., Buffalo, N. Y.

TRENTON, N. J.—Bids probably will be received Oct. 22 for the erection of the new plant for the Ajax-Grieb Rubber Co. Estimated cost, $25,000. Noted in issue of last week.

PITTSBURG, PA.—Plans have been prepared for the erection of a $200,000 2-story steel plant, 40 × 200 ft., for Mackintosh & Hemphill Co., foot of Twelfth St. and Allegheny River.

PHILADELPHIA, PA.—GEORGE KESSLER, Drexel Bldg., has been awarded the contract for a 1-story brick and steel, 60 × 140 ft., bottling plant, at Nos. 2523-25-27 North Broad St., for the Schlitz Brewing Co. Estimated cost, $50,000.

Milligan & Webber, Engrs., 520 Walnut St., have started plans for a 3-story reinforced concrete factory at 33d and Arch Sts., for A. H. Reid. Estimated cost, $50,000.

WAYNESBORO, PA.—The Geiser Mfg. Co. will have plans prepared for a 1-story brick and steel addition to its plant at this place. Power plant and special equipment will be installed.

HAGERSTOWN, MD.—The Brandt Cabinet Works have invited bids for the erection of a factory. It is to be a 4-story brick building, 60 × 150 ft.

WASHINGTON, D. C.—It is reported that the Carter Motor Car Co. will erect a $1,000,000 plant in this city. A. Gary Carter, Munsey Bldg., is Pres.

HAMPTON, VA.—The Citizens' Railway, Light & Power Co. is reported to erect a 50-ton ice plant either in this city or in Phoebus.

LOUISA, VA.—It is reported that a plant for the manufacture of brick from white and red clay will be established here.

MARTINSBURG, W. VA.—Consumers' Ice & Storage Co. is being organized with $35,000 capital stock to erect an ice and cold storage plant.

PARKERSBURG, W. VA.—The Graham-Bumgarner Co. has increased capital stock from $100,000 to $200,000 and proposes to erect an addition, five stories high, 40 × 50 ft., which will be equipped for the manufacture of men's heavy shoes. About $25,000 will be expended in building and equipment. T. E. Graham is Secy. and Treas.

RIVERSIDE (Wheeling Post Office), W. VA.—The Electrical Railway Equipment Co., of Cincinnati, Ohio, has purchased three acres of ground here on which, it is stated, a building, 25 × 250 ft., will be erected for the manufacture of electrical equipment. W. B. Stout, Cincinnati, is Gen. Supt.

LAGRANGE, GA.—Dixie Cotton Mills, the second oldest of LaGrange's five mills, is soon to be greatly enlarged.

CLERMONT, FLA.—The Clermont Ice Co., organized with D. G. Crenshaw, Pres.; William Kern, Vice-Pres.; C. H. Goodenough, Secy.-Treas., will erect ice and cold storage plant with a daily capacity of six tons. A building, 24 × 70 ft., will be erected; about $6,200 will be invested.

LAKE CITY, FLA.—The Lake City Mfg. Co. has organized with J. C. Sheffield, Pres.; A. R. Wise, Vice-Pres., and F. F. Bardin, Secy.-Treas. It has purchased building and is installing machinery for manufacturing knit goods, and later will install machinery for making paper boxes. A. D. Beatson is Mgr.

MONTICELLO, FLA.—E. B. Bailey is arranging for the establishment of plant to manufacture sand-lime brick; machinery to be operated by water power.

JACKSON, MISS.—The National Lumber Co. is reported as to expend $25,000 in improvements to ice plant, equipping for doubling the present capacity.

LOUISVILLE, KY.—The Colgan Gum Co., with offices at 321 Seventh St., has purchased a site on Breckinridge St., between Seventh and Eighth, running back 165 ft., and will erect a $25,000 factory. Plans have been prepared.

AKRON, OHIO.—B. F. Shaw, Gen. Supt. of the B. F. Goodrich Rubber Co., has awarded a contract to FRANK B. GILBRETH, of New York, for a reinforced concrete factory building and warehouse. The building is about 75 × 125 ft., five stories high and basement, and is designed to carry a load of 500 pounds a square foot. The cost will be about $75,000. The Osborn Engineering Co., of Cleveland, is the Design. Engr.

ASHLAND, OHIO.—The Faultless Rubber Co., of Akron, Ohio, will remove its plant at Akron to this city, and will erect a large addition to cost about $50,000.

CANTON, OHIO.—A new plant, including a main foundry building, 60 × 160 ft., a main machine shop, 60 × 140 ft., and a brick power house, 50 × 38 ft., will be erected here by the American Roll & Foundry Co., recently incorporated with J. B. Baird as Pres., William Gardner as Vice-Pres., Edward Langenbach as Treas., and D. A. Day as Secy., with a capital of $200,000. The Garrett-Cromwell Engineering Co., Cleveland, Ohio, is Engr. of the plant.

ALBANY, IND.—The Albany Automobile Co. has incorporated with a capital stock of $10,000. The company proposes to establish and equip a factory for the manufacture of automobiles, automobile parts and supplies. John L. Tully, James B. McNary and William L. Cary are directors.

BEDFORD, IND.—The Postal Auto & Engine Co. has incorporated with a capital of $20,000. The company will establish a plant to manufacture automobiles, engines and supplies. Sherman L. Keach and George P. Parks are directors.

EVANSVILLE, IND.—Plans have been prepared by Harris & Shopbell, Archs., The Rookery, 123 Fourth St., for the erection of a new factory, 400 × 160 ft., for the Standard Chair Mfg. Co.

The Hercules Body Mfg. Co., with capital of $50,000, has incorporated to construct a plant for the manufacture of all kinds of vehicles and parts. William H. McCurdy and F. M. Hillis are directors.

GREENSBURG, IND.—W. P. Skeen & Sons have let a contract to W. H. ISGRIGG & SON for the construction of a new foundry building and machine shop.

LAPORTE IND.—The Hobart M. Cable Co. is asking for bids for the erection of a large addition to present plant. Estimated cost, $15,000.

INDIANAPOLIS, IND.—The CAREY CONSTRUCTION CO. has been awarded a contract for the construction of a large brass foundry for Langenskamp & Wheeler. The building will be of concrete and brick. Estimated cost, $42,000.

The CENTRAL STATE BRIDGE CO., of this city has been awarded the contract for the structural iron work on the big repair shops of the Cleveland, Cincinnati, Chicago & St. Louis R. R., at Beech Grove, near this city.

TERRE HAUTE, IND.—The Modern Concrete Machine Co. has incorporated to construct, equip and operate a factory to manufacture concrete building block machines. R. L. Whaley and A. E. Harper are directors. Capital stock, $50,000.

LANSING, MICH.—The Michigan Screw Co. has been incorporated with $100,000 capital and will build a plant in this city to manufacture machine parts for automobiles and gas engines. M. R. Potter, Lansing, Secy.; Hugo Lumberg, of Detroit Screw Co., 246-248 Franklin St., Mgr.

NILES, MICH.—It is reported that the United States Furnace & Foundry Co., of Darlington, Pa., will erect a 2-story factory, 195 × 60 ft., here.

MILWAUKEE, WIS.—Plans have been prepared for the erection of a $30,000 brick and steel factory to be erected for the Carbolineum Wood Preserving Co., 128 Reed St. F. W. Anders, Arch., 533 Twelfth St.

Charles Crane, Arch., 89 Wisconsin St., has completed plans for a 7-story, solid brick factory building addition for the American Candy Co. It is to be 120 × 120 ft.

DAVENPORT, IOWA.—The Glucose Refining Co., with Lee S. Harrison, formerly superintendent of the Davenport plant, as Gen. Supt., and John F. Griffin as Gen. Mgr. of grain and real estate departments, will erect a plant 600 ft. long. Estimated cost, $400,000.

DULUTH, MINN.—A. R. and J. E. Merritt will erect a Puzzalean cement mill here.

CHATTANOOGA, TENN.—The Volunteer Disc Plow Co. proposes to increase its capital stock from $50,000 to $100,000. The powers of the concern are at present made at the plant of the Chattanooga Implement Works, at East Chattanooga, but it is understood that steps will soon be taken by the company to erect a plant of its own.

ST. LOUIS, MO.—The Condie-Neale Glass Co., Herbert D. Condie, Pres., will erect a large glass plant in North St. Louis at a cost of $500,000.

DALLAS, TEX.—The Fulton Bag & Cotton Mills, of Atlanta, have given out the contracts for the construction of their branch factory in this city. The building is to be five stories high, will cost about $80,000, and will produce bagging, bags and twine for supplying the Texas trade.

DUBLIN, TEX.—The committee appointed to formulate plans for the erection of the cotton mill met Oct. 8 in the office of J. H. Latham. It was decided to erect a mill to cost $150,000 instead of $100,000. The following committee of prominent farmers was appointed to canvass the county for the sale of stock: W. F. Gilbreath, Will Warren, Sam Bays and Frank Barnes. John H. Latham, R. W. Higginbotham and B. M. Utterback were appointed a committee to work the city for the same purpose.

OKLAHOMA CITY, OKLA.—Carl Porterfield, of Kansas City, Mo., will apply for franchise to install cold storage and steam heating plants. If franchise is secured, it is reported, a $200,000 plant will be erected.

COLORADO CITY, COLO.—It is reported that the Golden Cycle Mining Co. is to erect a 700-ton cyanide reduction mill here at a cost of about $500,000. John T. Milliken is Pres.

DENVER, COLO.—It is reported that C. A. Smith, of Boston, and Eastern capitalists, have organized the Flint Automobile Co., and will erect a factory which will cost about $600,000. Rufus W. Dean, Boston, Mass., is Pres.

SPOKANE, WASH.—The Rotary Engine Co. will erect a $15,000 factory here.

HULL, QUE.—The J. W. Woods Co., Ltd., has been granted an exemption of taxes for 10 years by the Hull City Council on construction and establishment of factory building and plant at an early date.

MISCELLANEOUS CONTRACTS.

The names of parties awarded contracts are printed in capital letters.

CEMENT.—New York, N. Y.—Bids are asked until noon, Oct. 19, for furnishing and delivering about 10,000 bbls. of Portland cement. J. A. Bensel, Comr. of Docks and Ferries.

DREDGING PLANT.—Detroit, Mich.—Bids are asked until 2 p. m., Oct. 22, for hire of dredging plant for use in St. Mary's River, Mich. Col. Charles E. L. B. Davis, Engrs. (Advertised, Engineering News.)

SUBWAY.—Reading, Pa.—Bids are asked until 2 p. m., Oct. 17, for construction of the subway under the Philadelphia & Reading Ry. tracks at Spring St. Elmer H. Beard, City Engr. (Advertised, Engineering News.)

EMBANKMENT.—East St. Louis, Ill.—Bids were received on Sept. 15, and rejected, for building clay embankment. The lowest bid was 73 cts. a cu. yd. New bids are asked until noon, Oct. 20. Silas Cook, Pres. Bd. Local Improvements.

RUBBER FIRE HOSE.—New York, N. Y.—Bids are asked until 10.30 a. m., Oct. 19, for furnishing 2,500 ft. of 1½-in. and 50,000 ft. of 2½-in. rubber fire hose. Also for 10,000 ft. of 3-in. and 1,100 ft. of 3½-in. rubber fire hose. John H. O'Brien, Fire Comr.

DREDGING.—Philadelphia, Pa.—One bid was received on Oct. 6 by the Bureau of Yards and Docks, Navy Dept., for dredging and filling in, Navy Yard, League Island, Pa. It was submitted by Henry Steers, 17 Battery Place, New York, N. Y., at 24¾ cts. per yd.

REVETMENT WALL.—Owen Sound, Ont.—Bids are asked until Oct. 27 by the Department of Public Works (Fred. Gelinas, Secy.), Ottawa, for constructing a pile and concrete revetment wall. J. G. Sing, Resident Engr., Confederation Life Bldg., Toronto.

BREAKWATER.—Goderich, Ont.—Bids are asked until Oct. 20 by the Bd. Pub. Wks. (Fred. Gelinas, Secy.), Ottawa, for the completion of breakwater at Goderich. J. G. Sing, Resident Engr., Confederation Life Bldg., Toronto.

CRANES.—Washington, D. C.—Bids are asked until 10 a. m., Nov. 13, at the Bureau of Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yard, Mare Island, Cal., three electric traveling cranes, under schedule 201. H. T. B. Harris, Paymaster-Gen., U. S. N.

TUNNEL ENTRANCE.—Boston, Mass.—Bids are asked by the Boston Transit Commission until Oct. 23, noon, for constructing an entrance and exit to the Washington St. tunnel, at the corner of Essex and Washington Sts. The structure will be mainly of concrete and steel. B. Leighton Beal, Secy.

TUNNEL.—St. Paul, Minn.—The Twin City Rapid Transit Co. has let contract for constructing its tunnel through Selby hill here to GEORGE J. GRANT, 709 New York Life Bldg. There will be 32,000 cu. yds. of excavating, 8,400 cu. yds. of concrete, 312,000 lbs. steel rods and 386 tons of old steel rails. Cost, $800,000.

LIGHTHOUSE VESSELS.—New York, N. Y.—The Department of Commerce and Labor has let the contract for the construction of four steel steam single screw lighthouse vessels to the NEW YORK SHIPBUILDING CO., of Camden, N. J. The four vessels will cost $396,000, to be delivered at the lighthouse establishment on Staten Island.

DREDGING.—Washington, D. C.—Bids were opened Oct. 8, at the office of the Commissioners of the District of Columbia, for dredging to the extent of about 4,000 cu. yds., at Anacostia, D. C. The following bids were received: A. Dean & Co., Alexandria, Va., 32 cts. per cu. yd.; John Miller, 1301 G St., N. W., Washington, 37 cts. per cu. yd.

ATHLETIC FIELD.—New York, N. Y.—Two bids were received by C. B. J. Snyder, Supt. School Bldgs., New York City, on Oct. 8, for the general construction, etc., of an athletic field on Crotona Park North, opposite Prospect and Clinton Aves., Boro. Bronx. Charles Mead & Co., 299 Broadway, $11,620; P. Kieran, Williamsbridge, N. Y., $7,773.

DITCHES.—Storm Lake, Iowa.—Bids were received on Oct. 3 by the Board County Supervisors at the office of the County Auditor, for constructing ditches in Drainage Dist. No. 4, Sections 1 to 6, consecutively, requiring about 1,550,000 cu. yds. Contract was awarded to TIMOTHY FOOKEY DREDGING CO., of Fort Wayne, Ind. Estimated cost, $165,000.

REPAIRS TO WHARF.—New York, N. Y.—Bids are asked until 11 a. m., Oct. 16, for material and labor required in the repairs to wharves at Governor's Island, N. Y. H. Information furnished on application. Envelopes containing proposals should be indorsed "Proposals for Repairs to Wharves," and addressed to Constructing Quartermaster, Governor's Island, N. Y. H.

DREDGING.—New York, N. Y.—Bids were received on Sept. 28 as follows by Col. W. R. Livermore, Engrs., Army Bldg., 39 Whitehall St., New York, for dredging in Passaic River, N. J.: John & Joseph McSpirit, 118 Wayne St., Jersey City, N. J., 75c. per cu. yd., based on scow measurement; P. Sanford Ross, Inc., 277 Washington St., Jersey City, N. J., $1 per cu. yd., based on scow measurement.

CONDUIT, EMBANKMENT.—Boston, Mass.—Bids are asked until Oct. 29, 2.30 p. m., by the Charles River Basin Commission, 307 Boylston St., for building section 4 of the Boston marginal conduit and section 2 of the Boston embankment, requiring about 145,000 cu. yds. of earth fill, 170,000 lin. ft. of piles, 5,700 cu. yds. of masonry and 900 cu. yds. of stone masonry. Hiram A. Miller, Ch. Engr. (Advertised, Engineering News.)

DREDGING.—Detroit, Mich.—The Buffalo "Courier" states that the DUNBAR & SULLIVAN DREDGING CO., of Buffalo, has been awarded the contract for dredging the big trench under the Detroit River, in which the Michigan Central Railroad tunnel tubes will rest. Work has been started about 800 ft. from the Detroit side of the river. William Hardison, who will direct the work for the contractors, states that navigation will not be interfered with.

TELEPHONE SWITCHBOARDS.—Detroit, Mich.—The Home Telephone Co. awarded the following contracts recently: The DEAN ELECTRIC CO., of Elyria, Ohio, was given the contract for all switchboards and telephones for the new exchanges. The contract amounted to nearly $500,000. STROMBERG CARLSOM & CO., of Rochester, N. Y., and JOHN A. ROEBLING SONS' CO., of St. Louis, were awarded contracts for cables amounting to over $500,000.

MOORINGS.—Tompkinsville, N. Y.—Bids are asked until noon, Oct. 25, for furnishing and delivering moorings for vessels and buoys of the Light-House Establishment during the fiscal year ending June 30, 1907. The articles to be furnished embrace chain for light-vessels, chain for buoys, mushroom anchors, bridle chains, swivels for light-vessel and buoy chains, and light-vessel and buoy shackles. Capt. J. A. Rodgers, U. S. N., Inspector, Third Light-House District.

COAL-HANDLING PLANT.—San Quentin, Cal.—Bids were opened Oct. 3, at the Bureau of Equipment, Navy Dept., Washington, for a complete coal-handling plant at the U. S. Naval Coal Depot, California City Point, Cal. The following bids were received, none of them, however, being strictly upon government specifications: Hoshor-Platt Co., New York, $87,893; $86,705 if geared engines are used; $85,600 if geared engines and tubular boilers are used. Augustus Smith, New York, $190,000. Snare & Triest, New York, on bidder's specifications: Item 1, $149,300; 2, $101,000; 3, $122,900; 4, deduct $9,700; 5, deduct $22,000. Occidental Machinery & Engineering Co. and Delmar W. Smith, San Francisco: Bid A, $310,842, $287,811; Bid B, $273,658, $248,924. San Francisco Bridge Co., San Francisco, $275,000; $4,000 for each chute; $250,000 if steel wharf trestle not required.

DAM WORK.—Glendive, Mont.—The Secretary of the Interior has executed a contract with the PACIFIC COAST CONSTRUCTION CO., of Portland, Ore., for the construction and completion of the Yellowstone dam and accessory structures, Lower Yellowstone irrigation project, Mont. and N. Dak. The dam is to be a rock-filled, timber-cribbed structure, located about 18 miles northeast of Glendive, Mont., for the purpose of diverting the waters of Yellowstone into a canal extending about 80 miles down the west side of the river for the irrigation of 67,000 acres of land, two-thirds of which lie in Montana. The work requires about 500,000 ft. of lumber, 700 piles, 1,600 sheet piles, 11,000 cu. yds. of rock filling and riprap, and 80 tons of steel. The contracting company will receive $142,825 for its work, which, according to the terms of the contract, must be completed Feb. 1, 1909.

DAM, CANAL WORK.—Mitchell, Neb.—Bids are asked until 10 a. m., Nov. 1, by the Secretary of the Interior, at Mitchell, Neb., for the construction of a diversion dam and headworks on the North Platte River, in Nebraska, in connection with the North Platte irrigation project. The work will involve the excavation of about 100,000 cu. yds. of earth and rock, furnishing and placing in structures about 10,000 ft. B. M. of lumber, and construction of about 8,000 cu. yds. of concrete masonry. Work on the North Platte project has progressed rapidly during the season. The first 45 miles of the Interstate canal has been furnishing water at several places for irrigation, but preparations for receiving it were incomplete and full use of the canal will not be made until next season. The second section of the canal is under construction and surveys for the third 50 miles are being made. Contracts have been awarded on 14 schedules of the distributing system and the work on the laterals is already in progress. The Pathfinder dam is progressing favorably and it is expected that about 15,000 cu. yds. of masonry will be laid before cold weather forces suspension of work. It is hoped that water can be delivered to about 40,000 acres under this project during 1907. (Advertised, Engineering News.)

CANAL WORK.—Albany, N. Y.—Bids are asked by N. V. V. Franchot, Supt. Public Works, Albany, N. Y., until noon, Nov. 8, on Barge Canal contract No. 19, Erie Canal, for excavating the canal and protecting its sides, rebuilding bridges, constructing a masonry culvert, concrete-capped pile docking and other incidental details between the guard lock at Sulphur Springs, Station 6148, and the mouth of Ellicott Creek, Station 6806; length of contract, 12.46 miles; work located in Niagara County; Engineer's estimate is $1,038,245; and on Barge Canal contract No. 26, Champlain Canal, for dredging a channel in the Hudson River, between the south end of contract No. 27, Station 1245, at Fort Edward, and the north end of contract No. 1, Station 1286 + 33; length of contract, 0.76 miles; work located in Washington and Saratoga Counties; Engineer's estimate, $51,625.

Bids are also asked until noon of Nov. 9 on Barge Canal contract No. 25, Champlain Canal, for excavating the canal and protecting its sides, constructing locks No. 9 and No. 10, necessary spillways, power plants and appertaining structures, bridge substructures and approaches, retaining walls, roads, and other incidental details, between Station 356, about 0.6 miles north of Comstock P. O. and Station 1041 + 54 at Dunham's Basin Road; length of contract, 13 miles; work located in Washington County; Engineer's estimate, $1,849,831; and on Barge Canal contract No. 27, for excavating the canal and protecting its sides; constructing Locks No. 7, No. 8, and junction lock, necessary spillways, power plants and appertaining structures; a concrete arch bridge, bridge substructures and approaches, retaining walls, highways and other incidental details, between Station 1046 + 16, the south end of contract No. 25, at Dunham's Basin Road and the Hudson River at Fort Edward, Station 1245. Length of contract, 3.76 miles; engineer's estimate, $998,920; work located in Washington County. (Advertised, Engineering News.)

U. S. POSSESSIONS AND CUBA.

The names of parties awarded contracts are printed in capital letters.

PILES.—Panama.—The Isthmian Canal Commission, Washington, D. C., has awarded to the SOUTHERN SAWMILL CO., New Orleans, La., contract for furnishing 4,000 piles of various sizes, at $33,642.

TRACK MATERIALS. — Panama. — The Isthmian Canal Commission has awarded to the UNITED STATES STEEL PRODUCTS & EXPORT CO., New York, contract under Circular 331, for furnishing 40,000 steel splice bars, 350,000 tie-plates, and 180,000 lbs. track spikes. It is not yet determined whether their bid f. o. b. Colon, or f. o. b. Baltimore will be accepted.

PROPOSED WORK.—Hawaii.—Lieut. J. R. Slattery, Corps Engrs., Young Bldg., Honolulu, advises us that the following construction work is planned for the ensuing fiscal year (July 1, 1906, to July 1, 1907): (1) New range lights, Honolulu Harbor, money available, $40,000; (2) first order light-house, Makapuu Point, Oahu, appropriation available, $60,000; (3) fortifications, amount available, $260,000.

ENGINEERING SUPPLIES. — Panama. — Bids are asked until 10.30 a. m., Oct. 23, at the office of D. W. Ross, Gen. Purchasing Officer, Isthmian Canal Commission, Washington, for a quantity of miscellaneous supplies, of which the following are of interest to engineers: Pipe fittings, lead pipe (50,000 lbs.), sheet lead (40,000 lbs.), cocks, throttle valves, milling cutters and mill ends, drill grinder, pillar crank shapers, bending rolls, flanging clamp, saw machine, rubber belting, water hose, cotton waste (50,000 lbs.), and miscellaneous hardware.

COAL-HANDLING PLANT.—Guantanamo, Cuba.—Bids were opened Oct. 3, at the Bureau of Equipment, Navy Dept., Washington, for a complete coal-handling plant at the U. S. Naval Coal Depot, Hospital Cay, Guantanamo, Cuba. The following bids were received, all more or less conditional: Hoshor-Platt Co., New York, $67,984, $66,810 if geared engine used, $66,605 if geared engines and tubular boilers used, $65,110 same as last bid, one instead of two trolley systems; Wellman, Seavor, Morgan Co., Cleveland, Ohio, $131,240; Robbins Conveying Belt Co., New York, $68,025, $67,800; Wm. L. Miller, Boston, $47,000, $44,000 extra if two bridges are required; Dodge Coal Storage Co., Philadelphia, $242,955, $66,790 for bridge tramway, $55,245 for additional bridge tramway; Snare & Triest Co., New York, on bidder's specifications, item 1, $67,600, 2, $67,600, 3, $58,000; Scofield Co., Philadelphia, bid A, $69,810, B, $58,960.

CEMENT, ETC. — Panama. — Bids were opened Oct. 2, at the office of D. W. Ross, Gen. Purchas. Officer, Isthmian Canal Comn., Washington, for miscellaneous engineering supplies under Circular 330, of which the following items are of interest to engineers: (a) 20,000 bbls. Portland cement, to be delivered by Jan. 15, 1907; (b) 3,525 pieces long leaf yellow pine, rough and dressed, various sizes; (c) 1,200 pieces white oak, rough. American Trading Co., New York, (a1) $41,450, (a2) $38,850; Atlas Portland Cement Co., 30 Broad St., New York, (a) $41,000; A. S. Bacon & Sons, Savannah, (b1) $9,307, (b2) $8,841, (c) $2,648; Alfred Hiller Co., New Orleans, (a) $51,000; Long Bell Lumber Co., Kansas City, Mo., (b) $7,079 f. o. b. New Orleans; Motley, Green & Co., 66 Broad St., New York, (a) $40,500; Panama Lumber & Trading Co., 1016 Hibernia Bldg., New Orleans, (b) $9,175; Southern Sawmill Co., New Orleans, (b) $9,839, (c) $2,478; Vulcanite Cement Co., Philadelphia, (a) $55,000; Wouldham Cement Co., by Carr Bros., agents, 32 Broadway, New York, (a1) $41,000, (a2) $51,500, foreign goods; Chicago Lumber & Coal Co., St. Louis, telegraphic bid, (b) $10,834, (c) $2,368.

FOREIGN CONTRACTS.

(To insure prompt attention, letters upon consular business should be addressed to the American Consul at ——, ——. Such letters are opened and attended to by the person that may be in charge of the office. If addressed to the consul, personally, letters are forwarded to him, unopened, should he be absent, and a delay thus intervenes. If, in the meantime, he should have gone out of office the matter may wholly escape attention.)

CANAL.—Bulgaria.—The Minister of War has available 1,360,000 francs (about $270,000) for construction of a canal connecting the Black Sea with Lake Devna. This work will be undertaken by the same company, probably, which has in hand the construction of Varna harbor.

PORT WORKS.—Spain.—Bids are asked until Oct. 30 at the offices of the "Junta de Obras del Puerto, Cadiz," for carrying out improvement and dredging works at the port of Cadiz. The cost of the work is estimated at $1,...2,733. A deposit of $17,000 is required to qualify any tender. Local representation is necessary.

RAILWAY WORK.—Belgium.—Bids are asked until Oct. 24 by the "Societé nationale des chemins de fer vicinaux," at offices of the "Societé" at 14 Rue de la Science, Brussels, for the construction of further sections of the railway from Hannut to Huccorgne on the local railways from Hannut to Vinalmont and Burdinne to Huy. The estimated cost of the work is 185,219 frs. ($37,000), and a deposit of 18,000 frs. ($3,500) is required to qualify any bid.

RAILWAYS, ETC.—Cape of Good Hope.—Two acts have been passed: (1) Providing for the construction, equipment, maintenance, etc., of certain lines of railway in the Colony, of a total length of 499 miles, at a cost of about $10,000,000; (2) authorizing the raising of a loan for the purpose of new and additional railway works, including the doubling of a portion of line (about $270,000) locomotive workshops (about $125,000), ice-making machinery (about $245,000), electric lighting ($245,000), etc.

COMPETITION FOR MOVABLE DAMS.—Bohemia.—Emil Timmler, Consult. Engr. to Austrian Government, announces that the attention of American engineers is requested regarding designs for movable dams for the rivers of Bohemia and Galicia. An international competition has been opened with the object of obtaining some type of movable dam which can be kept in use during the winter, so as to create a water-power available at all ordinary times. The rivers are subject to high floods and to ice, and extremes of temperature are also met with. For further details, data as to general conditions, lift, span, etc., address Mr. Emil Timmler, III Plass Gasse No. 616, Prague, Bohemia.

GARBAGE REDUCTION.—Spain.—The City Council of Barcelona has opened a competitive congress for machinery and processes for the extraction and utilization of garbage, rubbish, street sweepings and the sprinkling of streets. The machinery and processes should be of the largest and most approved inventions. The inventor to whom the first price shall be awarded must convey or cede the patent rights to the city of Barcelona. The awards are: 10,000 pesetas ($1,930) for the first prize; 7,000 pesetas ($1,350) for the second, and 3,000 pesetas ($580) for the third. Proposals are to be submitted to the Secretaria del Ayuntamiento, Barcelona, before noon, Dec. 1. (Advertised, Engineering News.)

CIVIL SERVICE EXAMINATIONS

ENGINEER AND CARPENTER.—Nebraska.—The U. S. Civil Service Commission announces an examination on Oct. 24, to secure eligibles to fill a vacancy in the position of Engineer and Carpenter, at $900 a year, in the Indian Service at Winnebago, Neb., and vacancies as they may occur in any branch of the service requiring similar qualifications. As no eligibles were secured as the result of the examinations announced for April 18 and June 13 for this position, qualified persons are urged to enter this examination. Application Form No. 1093.

CHIEF, WATER BUREAU.—Philadelphia, Pa.—A competitive examination for the position of Chief of the Bureau of Water, of the city of Philadelphia, will be held at Room 875 City Hall, Philadelphia, on Oct. 31, at 10 a. m. Applicants must be citizens of the United States, 30 years of age or over. Must be competent civil engineers, with executive capacity, and preferably with experience in the conduct of water-works. Must have technical knowledge equivalent to that required for graduation from a technical school of good standing. Need not be residents of the city of Philadelphia. Further particulars will be furnished upon written request to the Civil Service Commission, Philadelphia. (Advertised, Engineering News.)

TOPOGRAPHIC AND CARTOGRAPHIC DRAFTSMAN.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Oct. 30-31, to secure eligibles to fill three vacancies in the position of Topographic and Cartographic Draftsman, at $1,000 a year each, in the Office of Chief of Staff, War Department, and vacancies as they may occur in any branch of the service requiring similar qualifications. Age limit, 20 years or over on the date of examination. Competitors who attain a rating of less than 70 on the subject of drawing and lettering will not be eligible for appointment. Com-